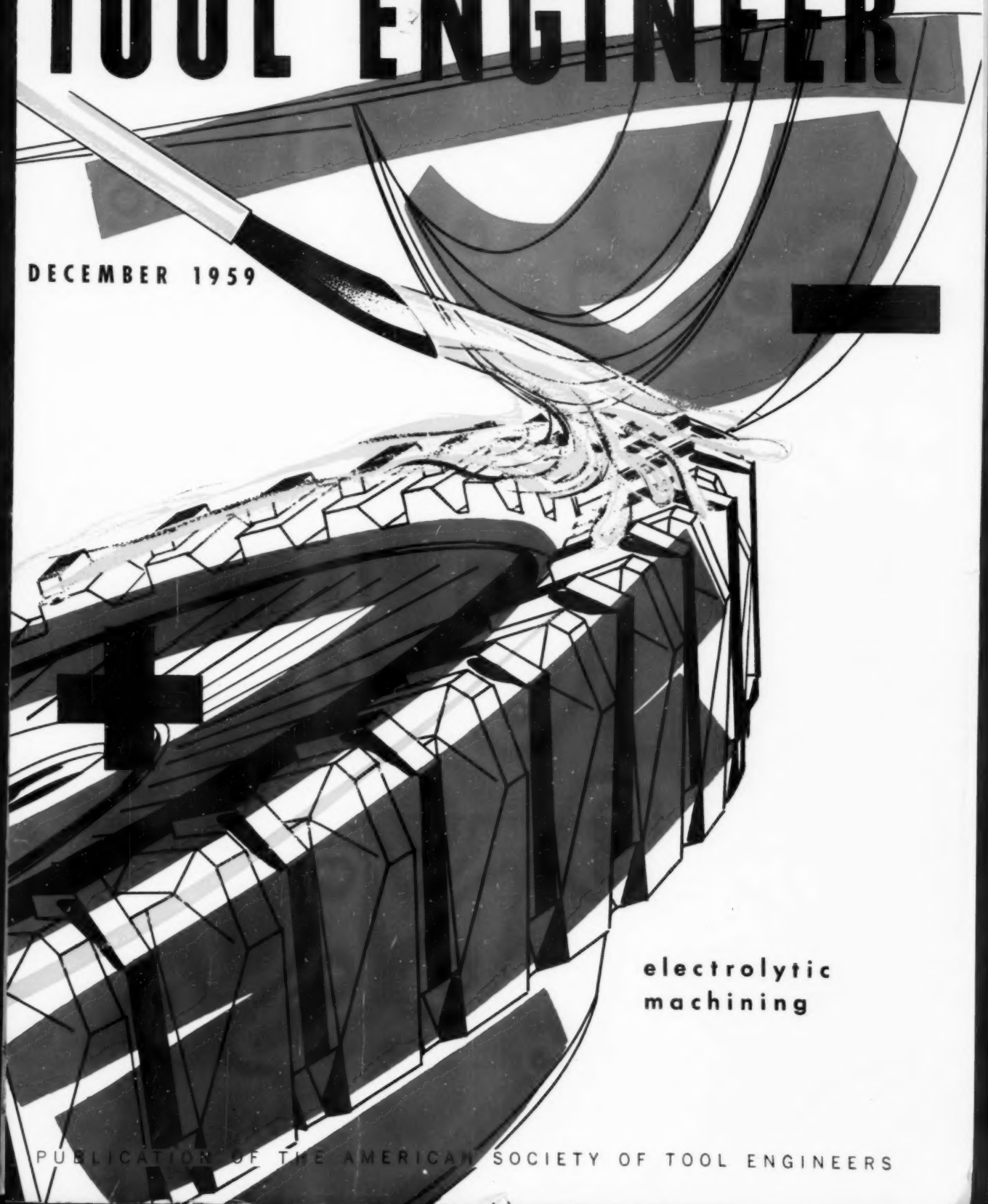
the

# TOOL ENGINEER

DECEMBER 1959



electrolytic machining

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

## if you surface grind small work

# CHUCK IT HERE

## on the HEALD MODEL 161 ROTARY

WHEN you want to get a better finish, easier and at *lower cost*, put your small surface grinding work on a Heald Model 161 Rotary. Available with a standard 6" chuck and 8" auxiliary top plate, it will handle work with a swing of up to 12½" inside the guard. On long runs or short, it will give you the high precision and fine surface finish that you'd expect only from a larger and much more costly machine.

Only the Heald Model 161 Rotary Surface Grinder offers you all these big-machine features in a small-size, low price unit: manual or power reciprocation — dry or wet grinding — simple operation — precision chuck swivel for flat, convex or concave grinding — powerful direct-drive wheelhead — vertical column construction — precision calibrated feed control — and anti-friction table with hardened steel box-type ways riding on hardened steel rollers.

Completely modern in every detail, this machine offers a low-cost solution to your rotary grinder obsolescence problems, or to the equally serious problem of tieing up a bigger machine on work than can be handled more easily and economically on the 161. Ask your Heald engineer for complete information, or send for Bulletin No. 2-161-1.

## THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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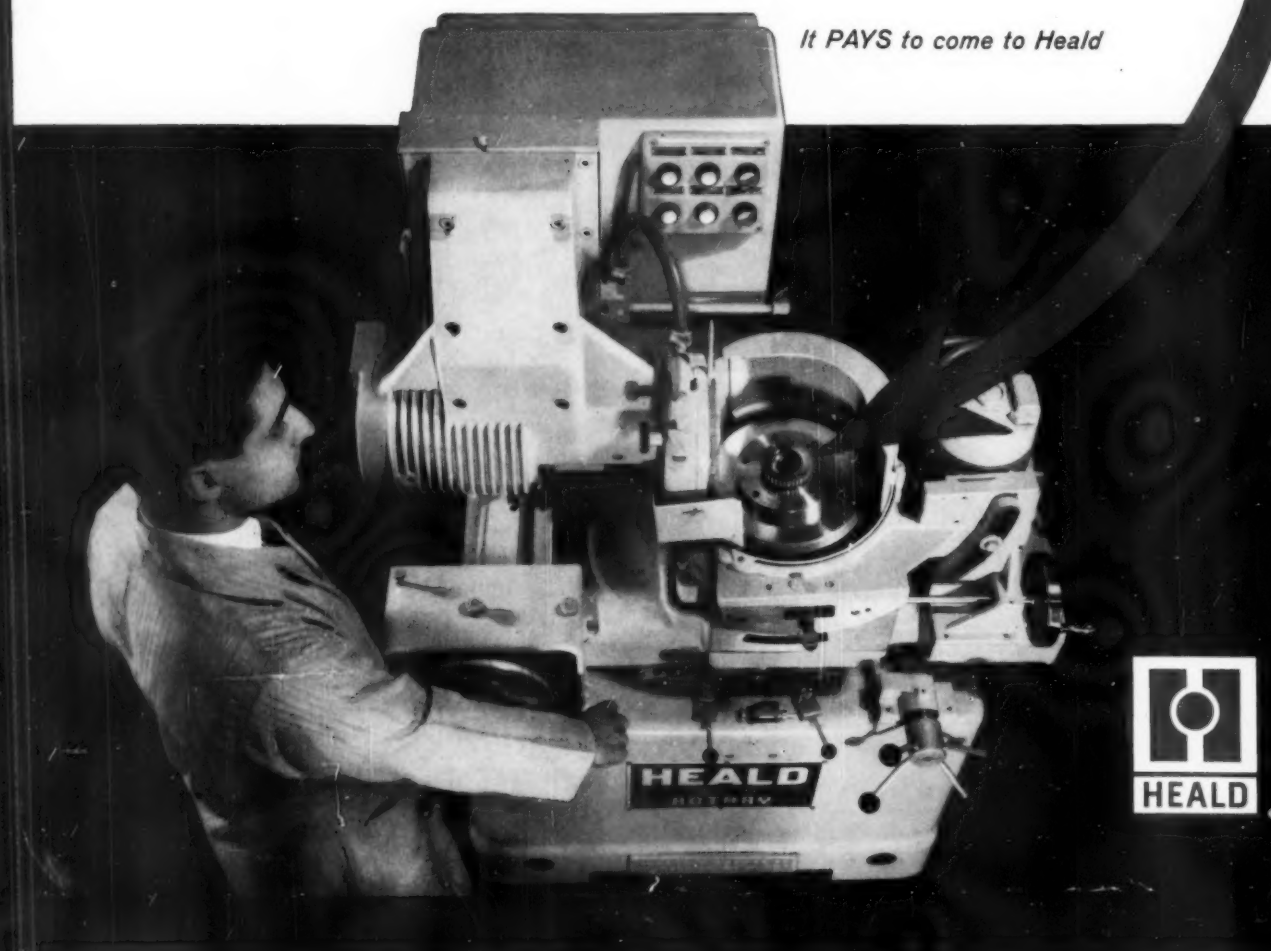
*It PAYS to come to Heald*



# the tool engineer

Vol. 43, No. 6
**December 1959**

Creative Manufacturing is TOOL ENGINEERING

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Management—the accomplishment of goals through others—requires technical competence as well as ability to plan and direct.

**Gadgets** ..... 39
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**How To Apply Electrolytic Machining** ..... *By Lynn A. Williams* 43
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**Piercing Automation for Short-Run Production** ..... *By T. W. Black* 55
Turret punch presses can be numerically controlled. One application is saving over $50,000 yearly. Programming is also automatic.

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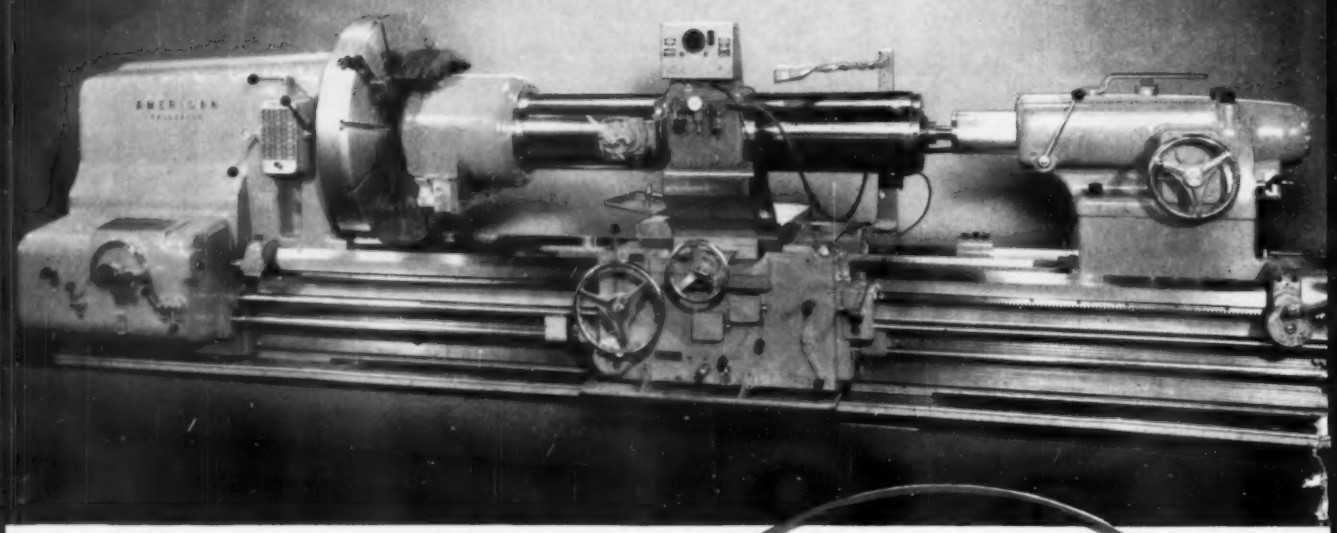
## THIS MONTH'S COVER

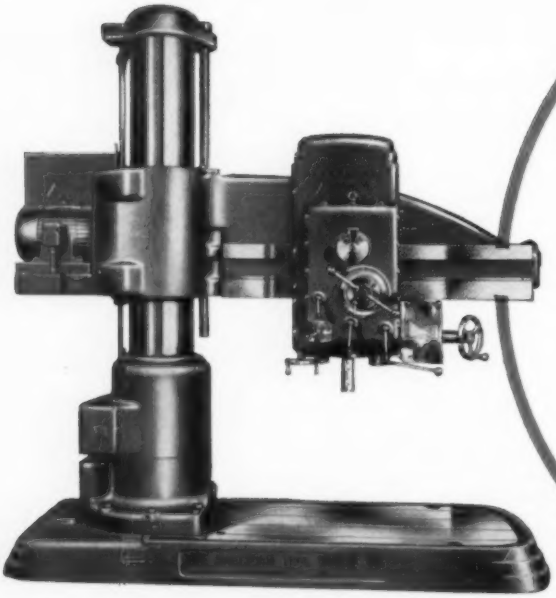
Because of its ability to machine hard materials, the electrolytic process is well-suited to tool grinding. Here the tungsten carbide inserts in a milling cutter are being sharpened. A conductive fluid passes between the work and the wheel. Flow of electric current results in a reverse plating action which is concentrated at the tool-work interface. Details are given in the article starting on page 43.

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index.*

# MIRROR FINISH

## . . . that Reflects not only LIGHT . . . but QUALITY





All "AMERICAN" Hole Wizard Radial Drill Column Sleeves are now super-finished to a beautiful "mirror" finish.

Not only does this vastly improve the appearance of the machine but which is far more important it minimizes the danger of column cutting and scratching.

This operation is done in our own plant on a brand new 40" "AMERICAN" Pacemaker Lathe equipped with a new No. 4 Gisholt Super-finishing attachment.

This represents just another step along the path of continuous modernization to improve the quality and also the inherent value of "AMERICAN" Lathes and Radial Drills.

Descriptive bulletin No. 328 will be of interest to you. It illustrates and describes many new and exclusive features.

**THE AMERICAN TOOL WORKS CO.** Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

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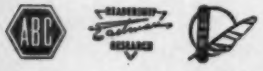

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# Evolution of a Profession

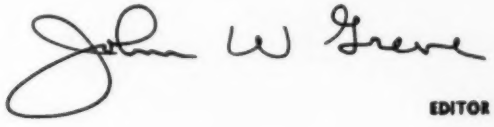
Many years ago, a group of dedicated men met to discuss the growing and expanding developments in production, particularly mass production. They realized that, individually, each could not keep abreast of the latest manufacturing techniques. Soon the accumulated knowledge would be more than an individual could grasp and organize for use. Cooperative efforts seemed to be the only answer. Further, they reasoned that if, in a group of ten men, each had a good idea and exchanged it with the others, everyone would be enriched. Each would have ten good ideas instead of one.

That was twenty-seven years ago. The seeds sown then, grew as the American Society of Tool Engineers, into a dedicated organization 40,000 strong. Webster's dictionary recognizes tool engineering as "a branch of engineering in industry whose function is to plan the processes of manufacture, supply the tools and integrate the facilities required for production of given products with minimum expenditure of time, labor and materials."

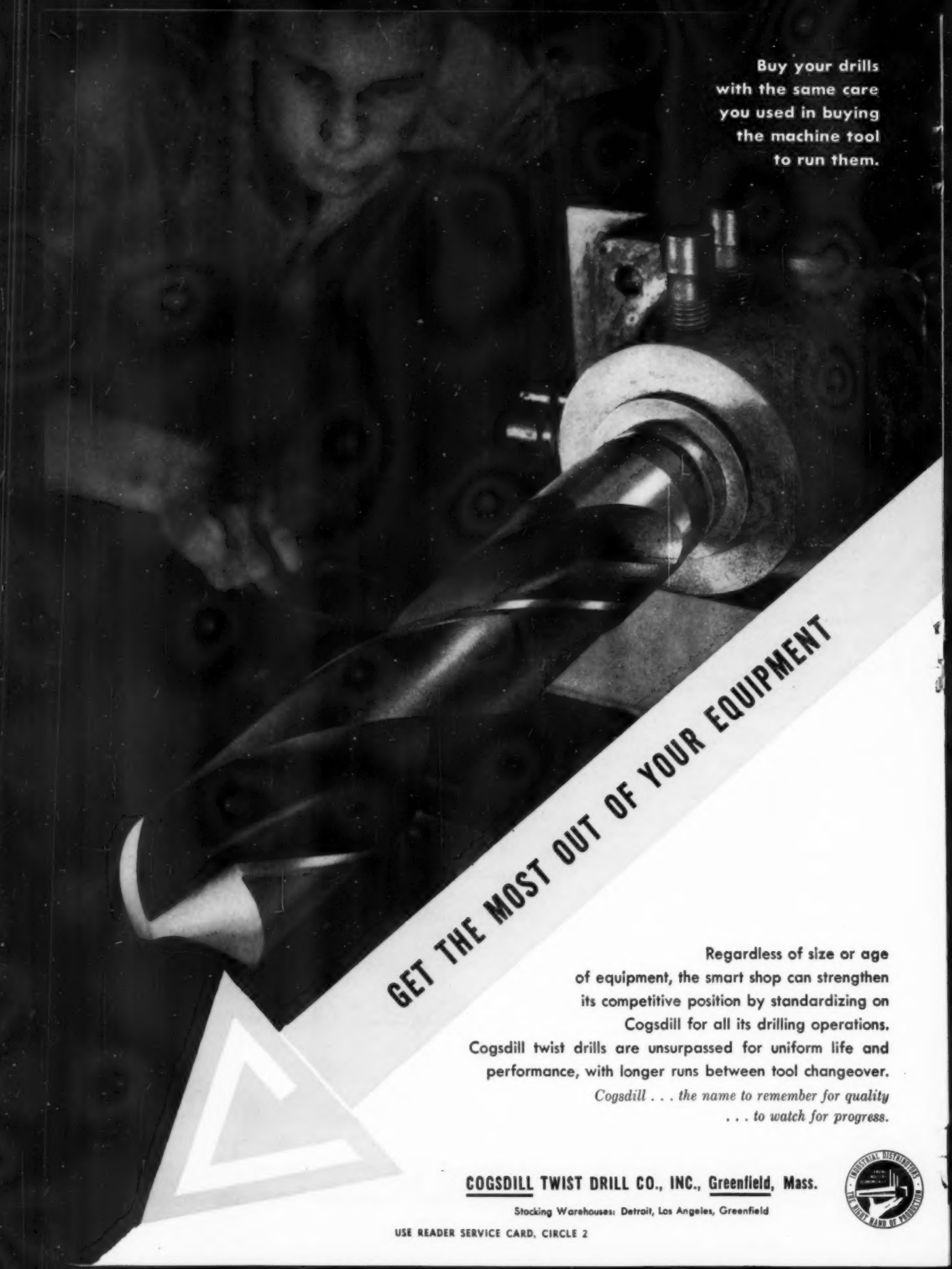
Then, as now, tool engineering embraced planning the manufacture of a product from the prototype to the shipping floor. As the profession grew, many new branches of tool engineering took root and several new titles blossomed to differentiate among the activities of different engineers. These include process engineer, methods engineer, manufacturing engineer and industrial engineer. In some cases, tool engineering became restricted to expendable tooling.

That could be natural evolution. When a branch of engineering comes of age, it becomes relatively complicated. Engineers specialize in fewer subjects to become expert. Names and titles mean different things in different companies or in different parts of the country.

Whatever the meaning and whatever the understanding, however, the job of the tool engineer remains the same: Use the latest and best method, technique or process to build the best product at the lowest cost and for the most customers.



**EDITOR**




Regardless of size or age of equipment, the smart shop can strengthen its competitive position by standardizing on Cogsdill for all its drilling operations. Cogsdill twist drills are unsurpassed for uniform life and performance, with longer runs between tool changeover.

*Cogsdill . . . the name to remember for quality . . . to watch for progress.*

**COGSDILL TWIST DRILL CO., INC., Greenfield, Mass.**

Stocking Warehouses: Detroit, Los Angeles, Greenfield

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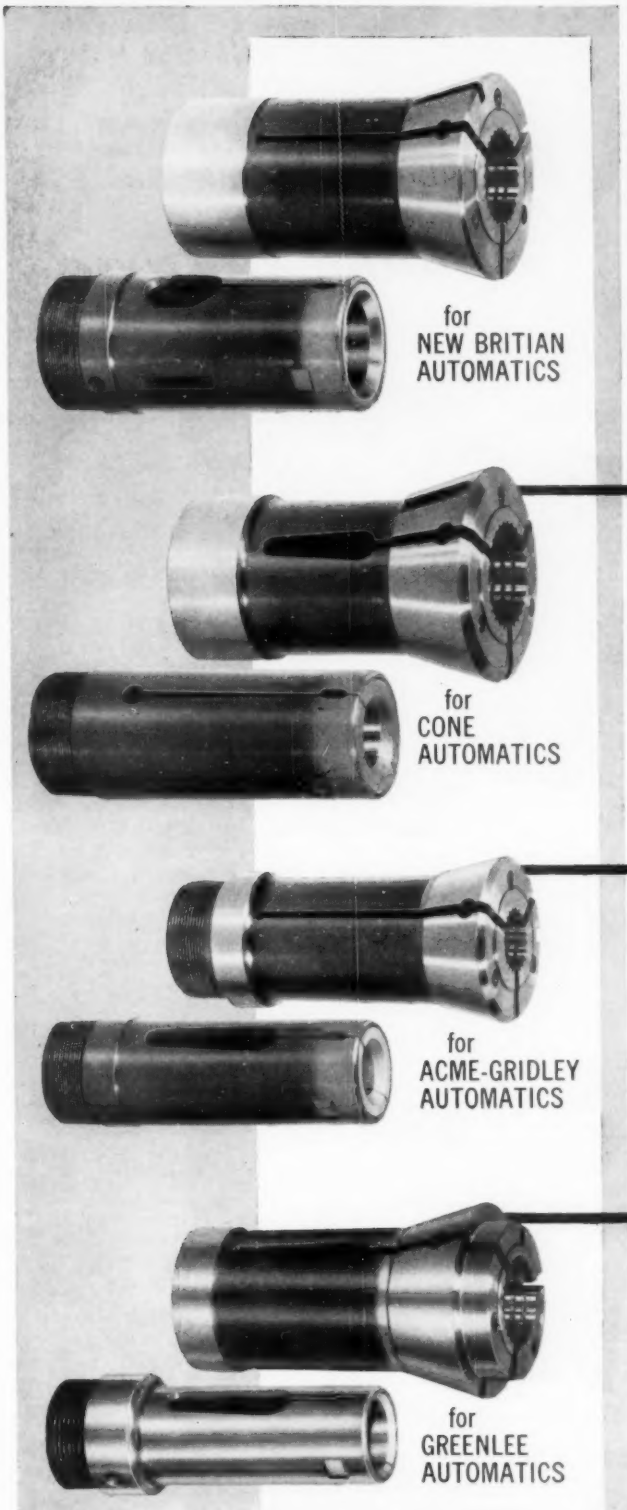


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Hardinge Master Collets
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both with low-cost, interchangeable pads —
solve production and cost problems
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Hardinge Style "S" Master Collets
are the only masters
*with no work pressure on the screw* . . .

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# SKF RACES *Against Time...*

*with the*

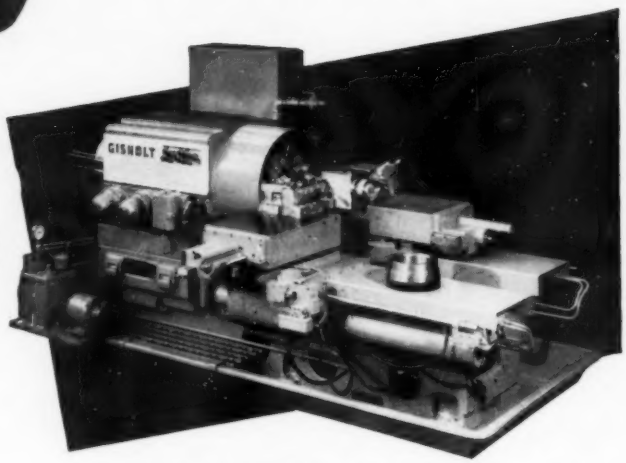
## GISHOLT NO. 24 HYDRAULIC AUTOMATIC LATHE

When it comes to fast production of top quality spherical roller bearing races, SKF doesn't fool.

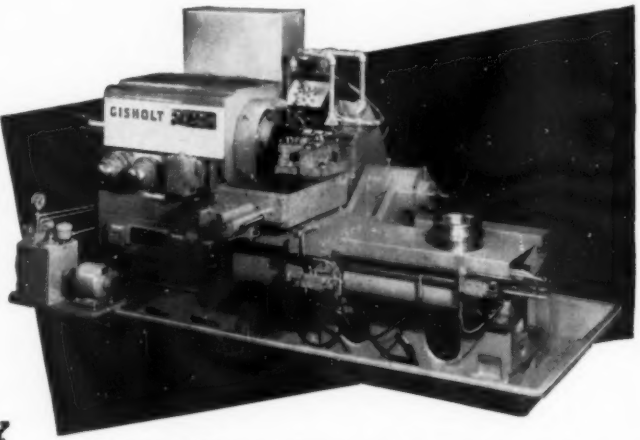
These big Gisholt No. 24 Hydraulics remove 34 lbs. of metal in two operations in a total of only 2.80 minutes' machining time on each of two machines. All cutting is on 52100 bearing steel and done at speeds of 325 to 350 f.p.m.

Speed is important, of course. But precision is the governing factor. How the Gisholt No. 24 does the job is a story that might mean real savings for you, too.

The No. 24 Hydraulic Automatic Lathe is a larger version of the famous No. 12 that has an outstanding success record on hundreds of jobs. If you have large volume precision work up to 24" diameter, the Gisholt No. 24 is the machine to investigate. Write for full information.




**First Operation:** Chucked on OD with 3-jaw hydraulic chuck, part is turned up to the jaws, faced, chamfered, bored and bore radius formed. Cam relief on rear tool block turns boring bit clear of workpiece as it is withdrawn.




**Second Operation:** Part held on expanding arbor by hydraulic pressure is finish turned, faced, chamfered and bore radius formed. Special rocker arm type carriage at rear tips in shaving tools to form both roller grooves with feed of .003" to .0045."

GISHOLT MACHINE COMPANY
*Madison 10, Wisconsin*

MASTERLINE GISHOLT SINCE 1887 GISHOLT

**ASK YOUR GISHOLT REPRESENTATIVE ABOUT GISHOLT FACTORY-REBUILT MACHINES WITH NEW MACHINE GUARANTEE**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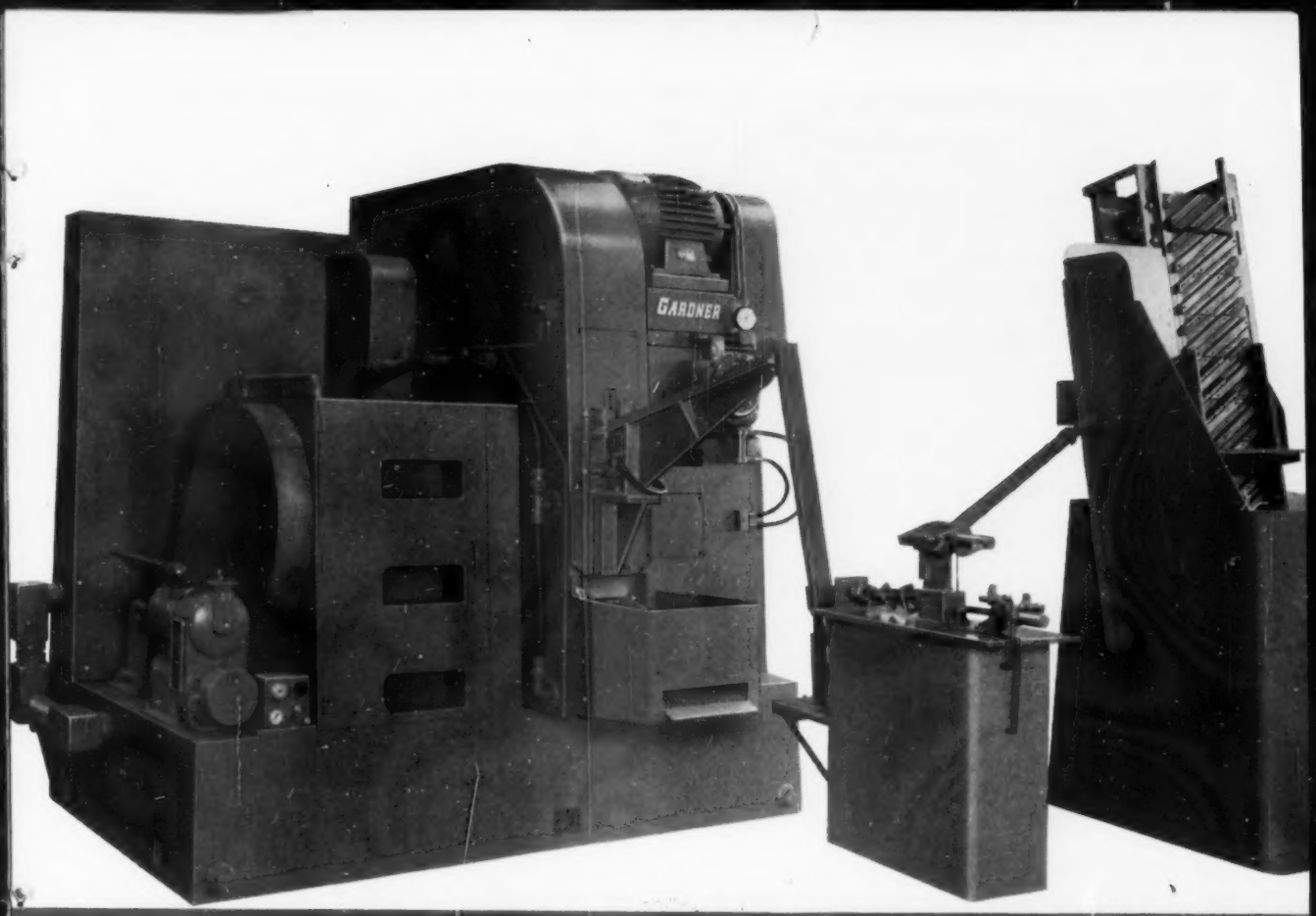
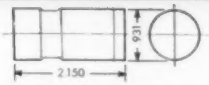
USE READER SERVICE CARD, CIRCLE 5




# Gardner automatic operation increases output . . . grinding hydraulic valve lifter bodies

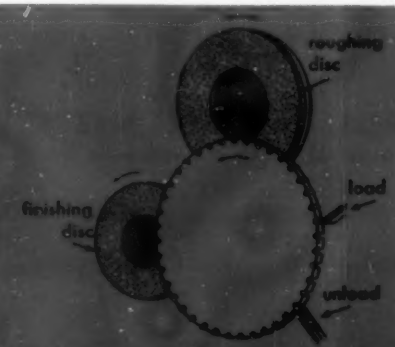



**production data**

| | |
|---|---|
| Operation | Grinding closed end of hydraulic valve lifter body |
| Material: | Cast iron |
| Rate: | 3000 per hour |
| Stock Removal— | |
| Rough cut: | .012″-.038″ |
| Semi-finish cut: | .006″-.008″ |
| Uniformity: | .002″ |
| Squareness: | .0005″ |

**special machine equipment**

hopper feed
transfer attachment
rotary carrier
two Gardner sizing units with automatic feedback
centralized lubrication
head zeroing gages
power-operated increment head feed
30″ & 23″ Yellow-Rim Wire-Lokt® discs
automatic loading and unloading




# GARDNER

precision disc grinders

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GROUND O. D.'S ready for use

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DRILL BUSHINGS FOR PLASTIC TOOLING

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TUNGSTON CARBIDE and *American* THINWALL® BUSHINGS

THE AMERICAN FAMILY of precision drill jig bushings is the most complete to be found anywhere. Large stocks of A.S.A. and American Standards are available at our exclusive Distributors throughout the U.S. Specials or unusual bushing requirements receive prompt attention.

Send for your free copies of the 1960 catalogs for the complete line

*American*

DRILL BUSHING CO.

5107 Pacific Blvd. • Los Angeles 58, Calif.

Carrying the LAPOINTE name plate with all that this means in engineering design and quality of manufacture,

this BENCH SIZE LAPOINTE

# BROACHING MACHINE

## fills a particular need in the field of broaching

### SPECIFICATIONS

Lapointe EB Broaching Machine, 1½-ton, 12-inch stroke. Broaching speeds, 5 and 10 f.p.m.

Size of platen, 17" x 18½"

Hole in platen, 5"

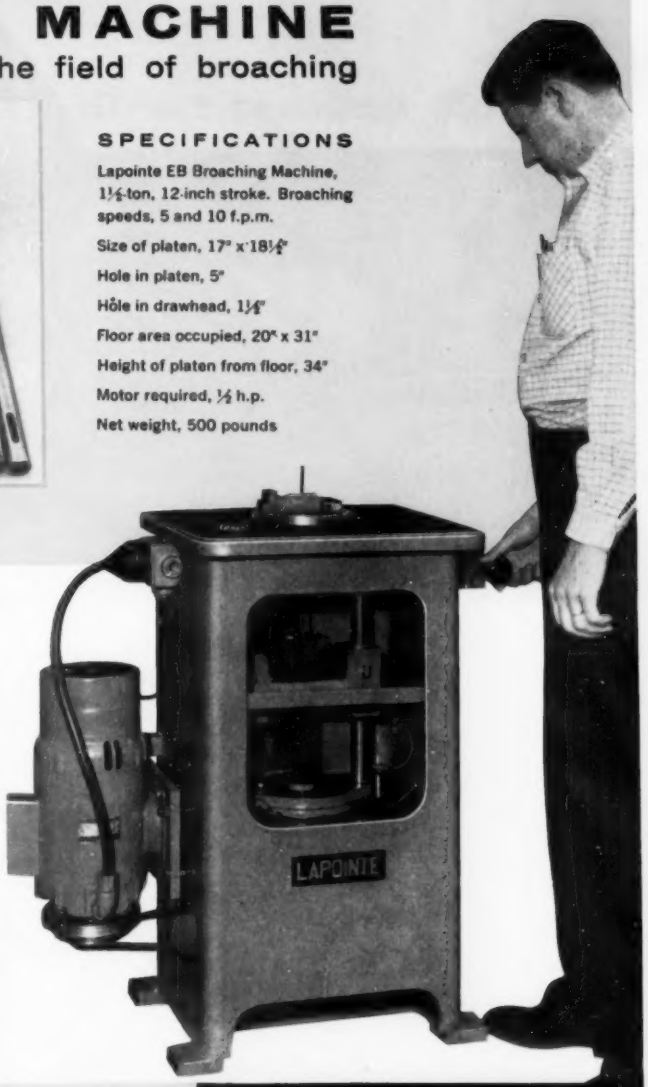
Hole in drawhead, 1⅛"

Floor area occupied, 20" x 31"

Height of platen from floor, 34"

Motor required, ½ h.p.

Net weight, 500 pounds




**PRICED AT $970,** this small, compact LAPOINTE Broaching Machine is built for *precision broaching* — like all other Lapointe Broaching Machines. It is eminently suited to the broaching of SMALL MISSILE PARTS because of its ability to perform to the extremely close tolerances required in that field.

**Such parts as missile valves, lock cylinder barrels,** various slots, and other internal applications are broached easily on this machine. It is excellent for *finish broaching,* where stock removal requirements are not heavy.

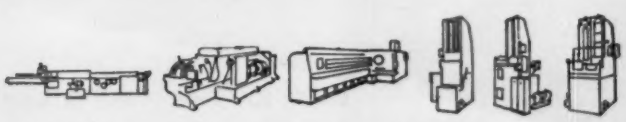
**Portable, and usable wherever it can be plugged** into a 110v outlet, this small Pull Down Broaching Machine is designed with direct-line pull on the broach, thus eliminating the strain encountered when broaching with machines of the older type.

*Write for Bulletin EB-1.*

**THE LAPOINTE MACHINE TOOL COMPANY**

HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



LAPOINTE

known to be the best in

BROACHING

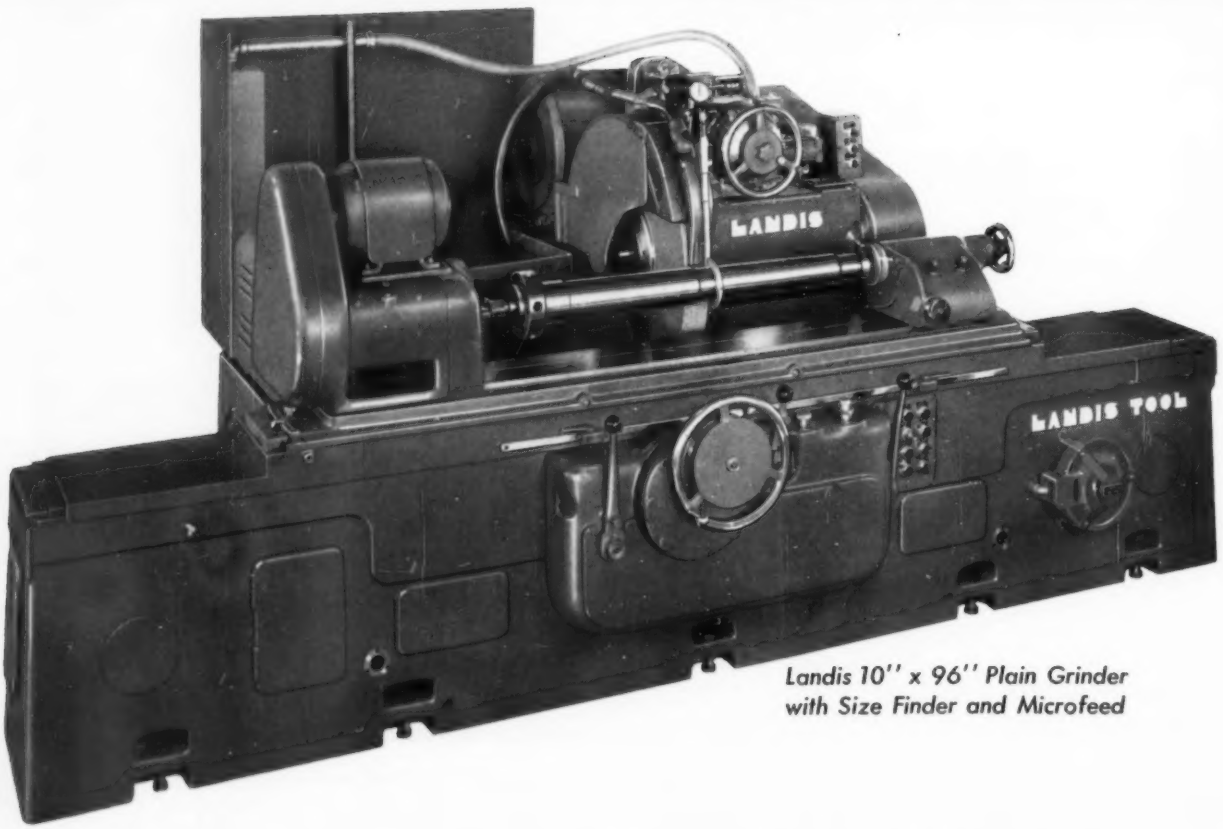
# New idea cuts cost

## LANDIS size finder with MICROFEED

Positive direct reading size finder cuts setup time

Landis MICROFEED assures "tenths" tolerances consistently

Eliminates costly rejects

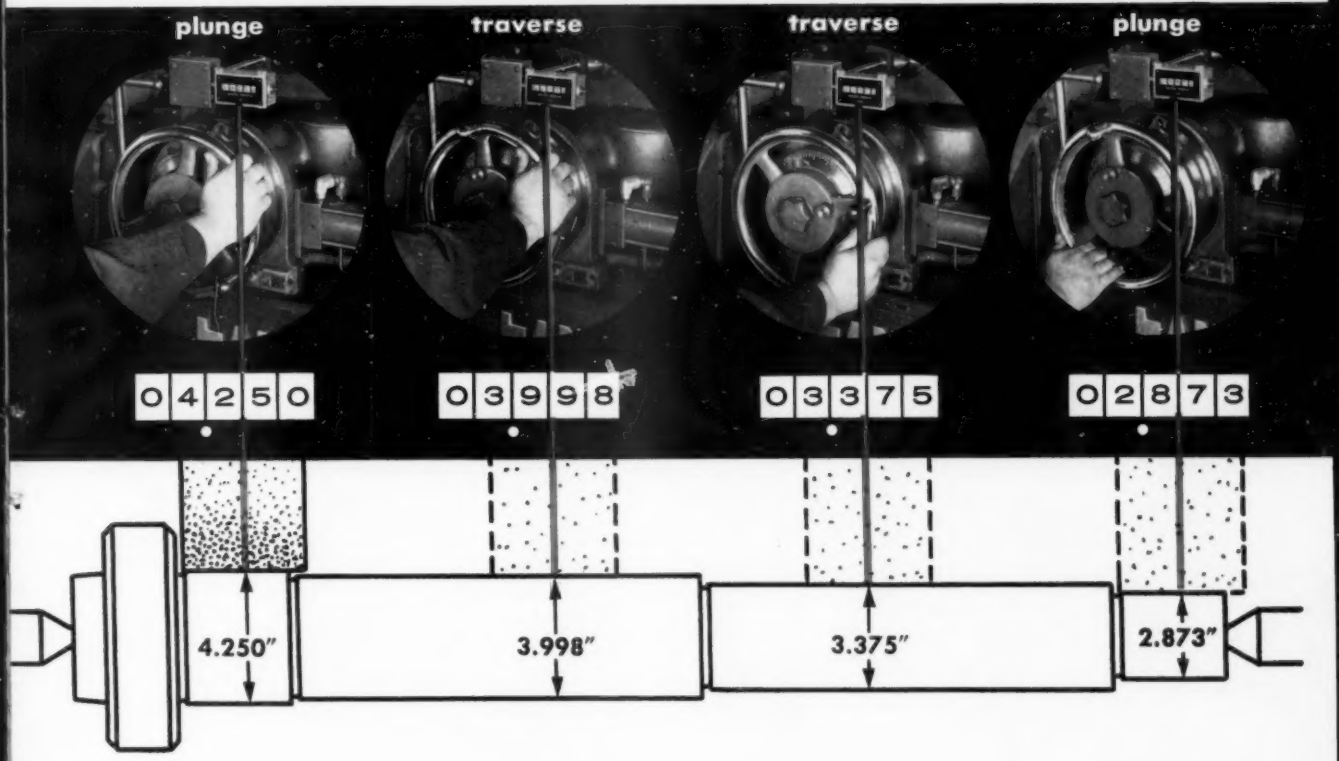



*Landis 10" x 96" Plain Grinder with Size Finder and Microfeed*

# of grinding shafts

## shows remarkable savings on small lots

### finish sizes set on direct reading dial




**how size finder works**

The operation of the machine is simple, even for unskilled operators. It's only necessary to set the finish dimension on the indicator by turning the wheel feed handwheel. Operator starts the cycle, applies the sizing gauge and stops the cycle when the gauge shows finish size. He moves the work table, resets the Size Finder for the next diameter and repeats the cycle.

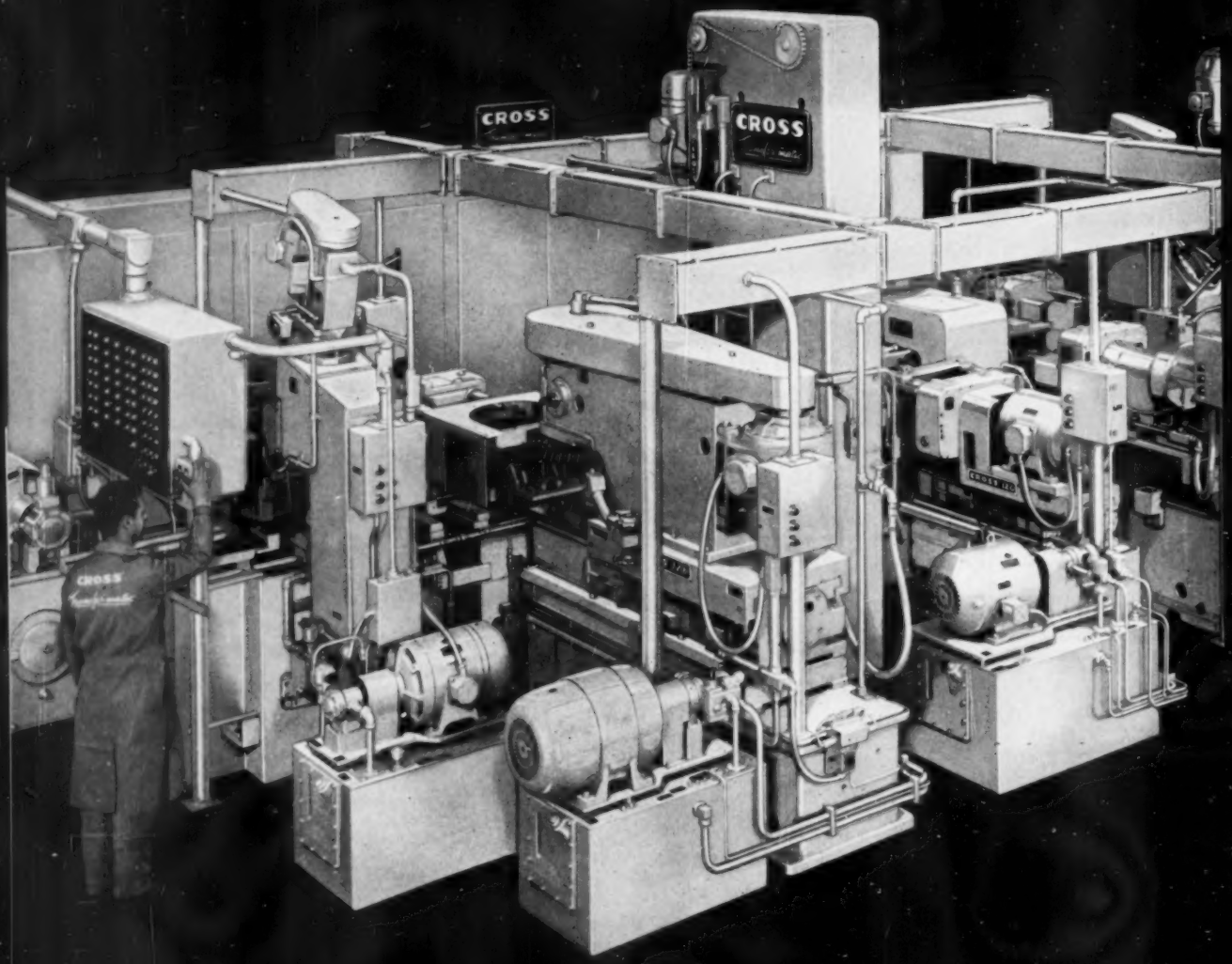
You can make large savings on your small lot multiple diameter shaft grinding operations. Send us prints of your shafts for our proposal.

**LANDIS**

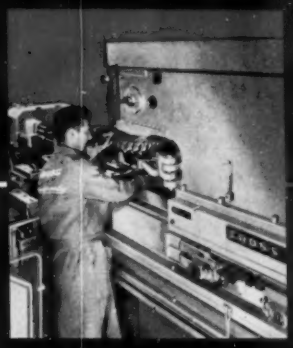
**precision grinders**

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

# New Cross Transfer-matic Developments Reduce Machine Down Time Problems

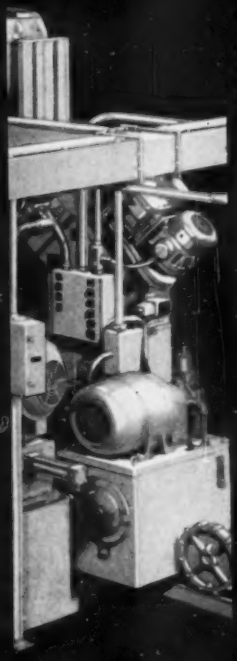


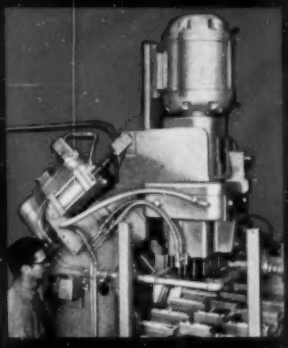

PART: Crankcase assembly.
OUTPUT: 128 pieces @ 100%.
OPERATIONS: Milling, drilling, reaming and tapping.



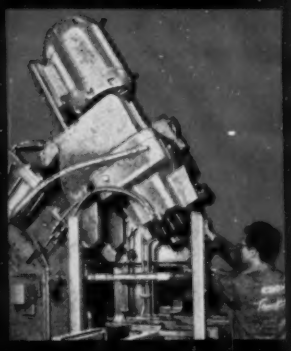
The cutter changing mechanism overcomes problems usually encountered where heavy, large diameter milling cutters are mounted on vertical spindles.

The head is a standardized Cross adjustable spindle "building block" unit for heavy duty production milling.





As shown above, the "swivel head" is in operating position. For changing tools, the head is "swiveled" by a manually controlled hydraulic cylinder as shown below.



# *More Automation Progress by Cross*

## *Innovations For Greater Accessibility, Faster, Easier Tool Changing and Electrical Trouble Shooting*

Several new design developments in this Cross Transfer-matic for machining 6-cylinder, aluminum crankcase assemblies contribute significantly to reduced predictable and unpredictable machine down time for tool change and electrical trouble shooting.

**LESS PREDICTABLE DOWN TIME:** A cutter changing mechanism on the milling head at Station 4 handles the cutter for the tool set-up man, speeds up cutter replacement, prevents blade chipping and promotes safety.

In the final station of the machine, a new "swivel mounting" arrangement is employed on a 19 spindle tap head. For changing tools, the head is swiveled out of the work area thus providing maximum accessibility for easier, fast tool changes.

**LESS UNPREDICTABLE DOWN TIME:** Electrical trouble shooting on this machine is greatly simplified by another new Cross development—integral machine unit push button-terminal stations. All terminal wiring formerly located in the wing base has been combined in the push button panel. By removal of all wiring from inside the wing bases, unpredictable electrical failure from exposure to coolants and moisture in the base is prevented and accessibility minimizes downtime for trouble shooting.

To prevent scratching and scuffing of the locating surfaces of this aluminum part, a lift and carry mechanism is employed.

Cross "building block" construction permits economical conversion as part design changes occur.

In your next tooling job, make Cross Transfer-matics your first choice for production milling, drilling and boring operations.

*Established 1898*

**THE CROSS CO.**

***First in Automation***

**PARK GROVE STATION • DETROIT 5, MICHIGAN**

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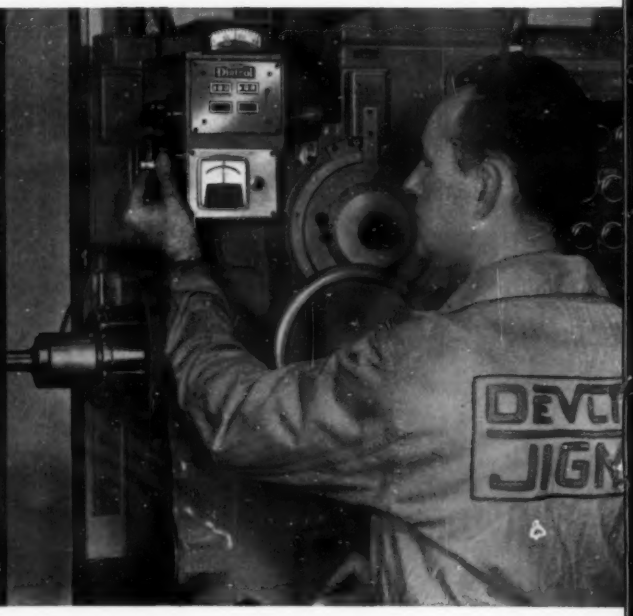
NEW FROM FAIR STREET • HOME OF THE JIGMIL

# dia

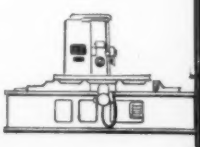
## direct dial dimensioning system

"THE DIATROL SYSTEM OF AUTOMATIC POINT-TO-POINT POSITIONING SPEEDS UP SPINDLE LOCATION, SIMPLIFIES CONTROL AND ASSURES ACCURACY"



"Simply dial in the pre-selected coordinate dimensions, touch a button, the rest is automatic. The JIGMIL table and spindle head automatically position at the desired hole location in seconds. While the JIGMIL is machining, you can *pre-set* your next move. Developed by our own engineers, Diatrol adds to the inherent versatility and accuracy of the JIGMIL, further reducing human error as well as set-up and machine time. *Diatrol makes it possible to machine custom or small lot jobs at production rates.*"

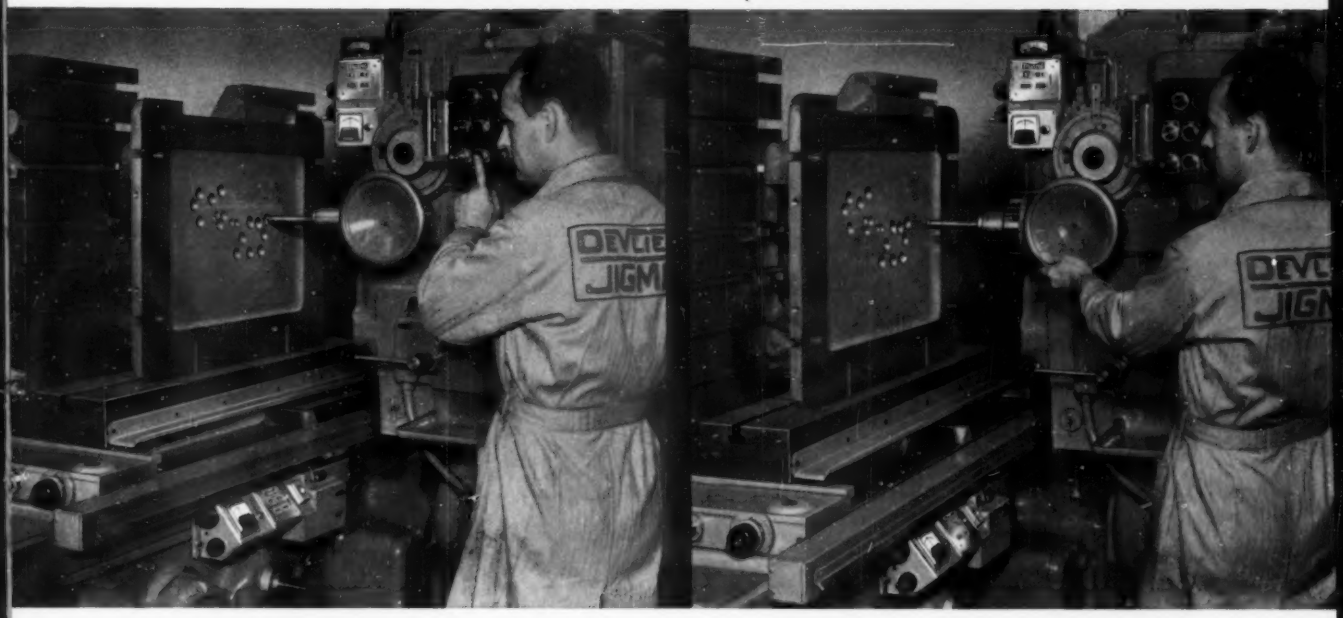
C. R. DE VLIEG



DEVLIEG MACHINE COMPANY, FAIR STREET • ROYAL OAK, MICHIGAN

# trol®

## for DeVlieg Spiramatic Jigmils



**Simple! Accurate! Automatic!** Diatrol is a transistorized electro-mechanical system, simple in design and simple to operate. All settings are made on direct reading dials; one dial for horizontal, the other for vertical dimensioning. Direct dialing of positive or negative dimensions is possible from any arbitrarily selected datum plane or zero point within the range of the system. Coordinate dimensions can be fed direct from the blue print, eliminating much of the mathematics formerly required for accurate jig boring. Measurement and positioning accuracies are controlled to one-ten-thousandth of an inch. Developed exclusively for the JIGMIL, Diatrol is now available for the complete range of JIGMIL precision boring and milling machines. For complete information, write or arrange a visit to Fair Street.

Rewarding revelations in precision await your visit to Fair Street

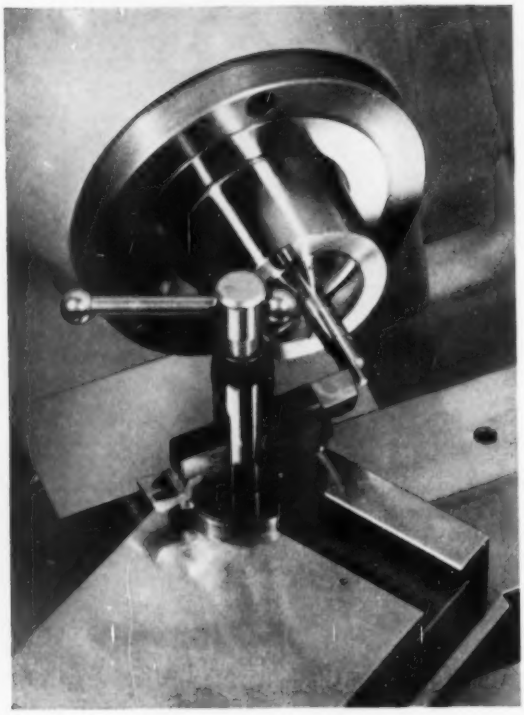
..... HOME OF THE JIGMIL

# DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

USE READER SERVICE CARD, CIRCLE 10



*When*

# ACCURACY

## REALLY COUNTS

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## PRECISION DRAW-IN COLLETS

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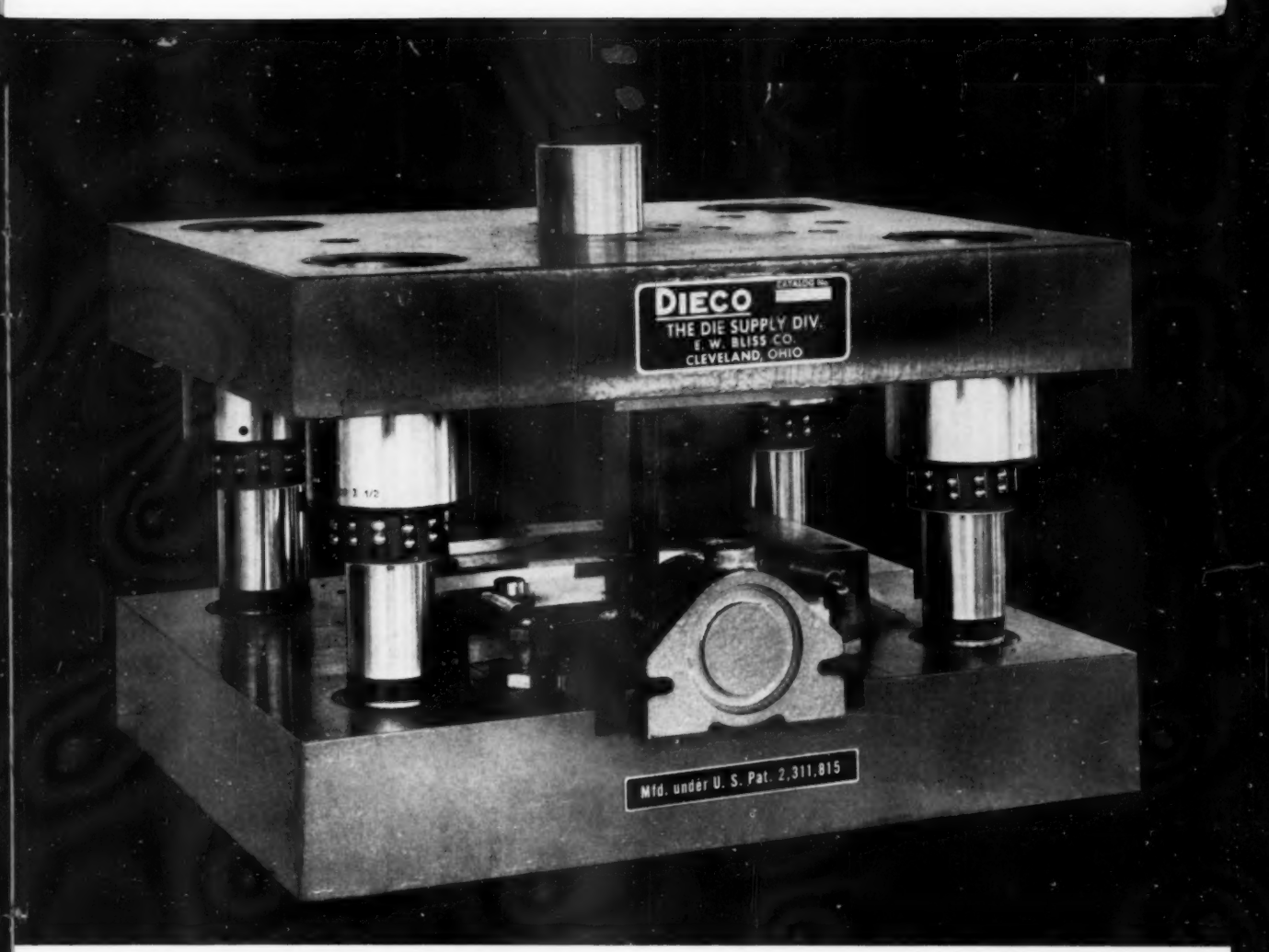
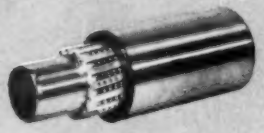



# New Bliss ball bearing die sets shrink hours into minutes in die making and changeover!

**Here are seven reasons why...**



- Negative clearance means longer die life. No die shifting. Misalignment is eliminated.
- Ball bearing construction speeds assembly and disassembly. Yet installation is conventional. Die builder doesn't work in reverse.
- Smooth even preloading prevents shock...assures alignment of punch and die. Off-set design reduces wear.
- Easy oiling and maintenance. Loosen the set screw, the retainer is out and back in minutes.
- Eliminates downtime caused by seized pins and bushings.
- Standard components—no need to stock or wait for specials.
- Existing sets can be easily and economically converted to Bliss-Dieco ball bearing design.

Mfd. under U. S. Pat. 2,311,815

**Note:** Bliss-Dieco ball bearing assembly can be stripped from guide post on inclinable or straight side presses.

**USE READER SERVICE CARD, CIRCLE 13**

Bliss' patented ball bearing die set has money and time saving advantages no other die set has—conventional or otherwise. It gives you more burr-free parts between regrinds...fewer rejects.

It's the most revolutionary change in bearing design to hit the die industry in years. Assembly and disassembly are a snap. Die making and tryout time are slashed. No more time lost because of seized pins and bushings.

Pre-loaded ball bearings provide *negative clearance* for perfect die register, even after millions of hits.

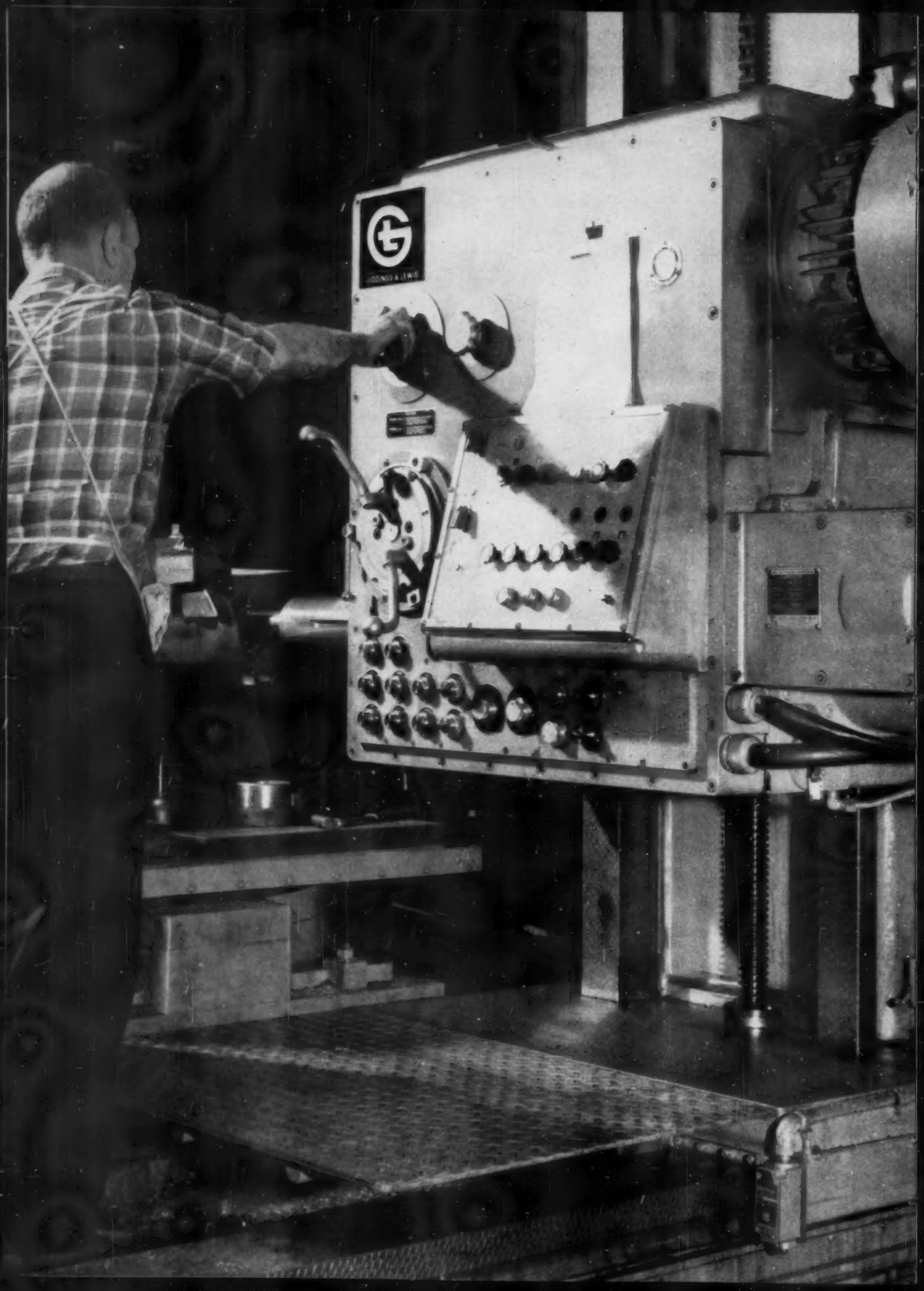
What's more, cleaning and lubrication are a matter of minutes with this unique die set: You just loosen the self-locking set screw, drop the bearing retainer, clean it, reposition it and tighten the screw again. Light bearing oil is all that's needed.

In short, with the Bliss ball bearing die set you get maximum die life—"cleaner" parts—fewer die breakdowns. For further information, write E. W. Bliss Company, Die Supply Division, 1400 Brookpark Road, Cleveland, Ohio. We'll be glad to send you an illustrated technical bulletin that will tell you how you can have ball bearing die sets at a surprisingly low cost or how you can convert your existing die sets to the new Bliss-Dieco design.

**dieco** DIE SETS

**E. W. BLISS COMPANY**
**DIE SUPPLY DIVISION**
**Cleveland, Ohio**

**USE READER SERVICE CARD, CIRCLE 14**



# Jigs and fixtures "traded" for tape

## $44,954 savings first year

James Rowley, superintendent of the milling and grinding machine group at Brown & Sharpe Mfg. Co., Providence, Rhode Island, expects his new Giddings & Lewis tape-controlled horizontal boring, drilling, and milling machine to pay for itself in a hurry.

Savings in production hours are running at the rate of $8,594 per year on jobs like those illustrated at the right. On the same jobs, net savings in tooling have totaled $36,000.

Programing requires no special skills or capabilities — a knowledge of part layout and job setup is all that is required to prepare data. Programing and preparation of tapes for many jobs can be done within several hours.

Economic justification for the Numeripoint*-controlled G&L was an open and shut case when Brown & Sharpe faced the cost of tooling for production of a new line of machines. It quickly was determined that the tons of jigs and fixtures required could be "traded" for the new tape-controlled machine. Added advantages of tape: greatly reduced lead time, freedom to modify design almost at will because of the moderate cost involved, reduced handling, lower unit production cost, improved accuracy, and reduction in human error.

Giddings & Lewis tape-controlled horizontal boring, drilling, and milling machines are providing competitive advantage for manufacturers of power generation equipment, printing presses, construction machinery, machine tools, and transportation equipment.

The direct savings and plus-benefits of tape control are proved and ready for your company. For complete information and cost analysis, consult your local G&L distributor or write to GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond du Lac, Wisconsin.

Giddings & Lewis Model 3045 horizontal boring, drilling, and milling machine with Numeripoint* control and rotary table.

*Numeripoint is the G&L trade-mark for its punched tape discrete positioning system.

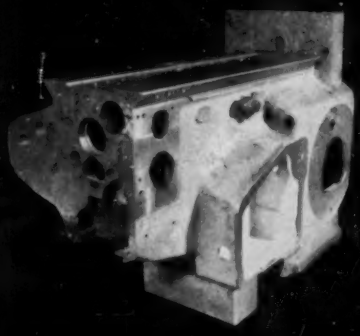
**GIDDINGS & LEWIS**

Giddings & Lewis manufactures: vertical and horizontal boring machines, vertical turret lathes, planers, planer mills, contour milling machines, die sinking machines, drilling machines, numerical and tracer control systems, boring tools and related items, and machine tool accessories.

HBM-101

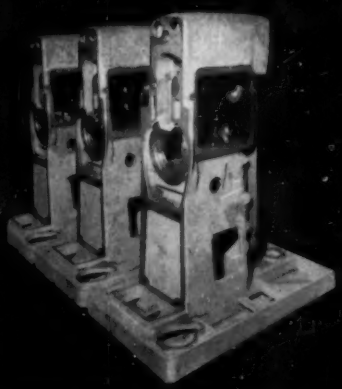
USE READER SERVICE CARD. CIRCLE 15

**78% timesavings** in machining arbor yokes.

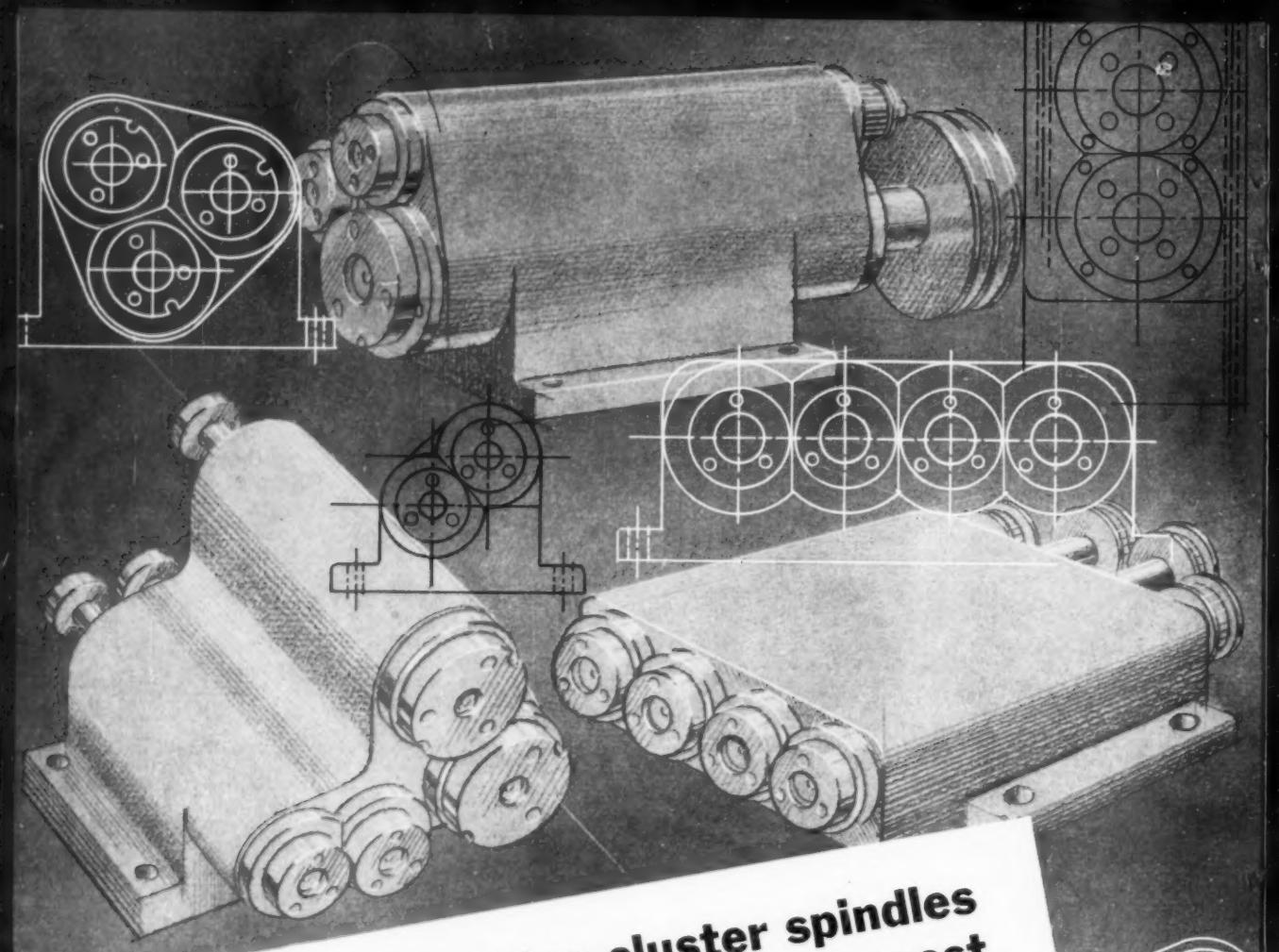


**42% savings** in production time on this milling machine knee were achieved principally through reduction in handling.

**38% savings in unit hours** on this grinding machine bed proved the advantage of tape control over a specially set up rotary table machine.



**50% savings** in production time on these milling machine stands — milling, rough and finish boring, drilling, and tapping. Each of the four sides is machined automatically by 90° rotations of the table.



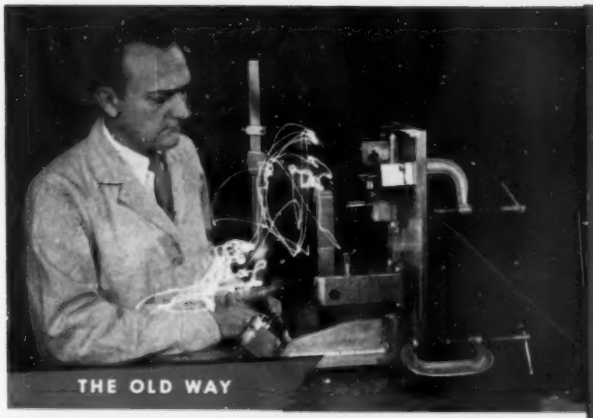
# Whitnon precision cluster spindles for improved accuracy at lower cost

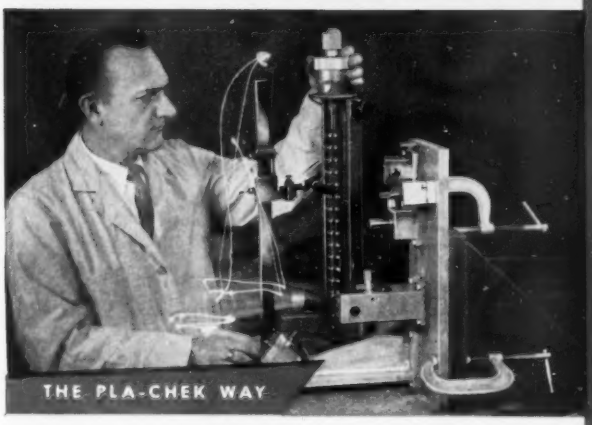
Whitnon multiple-shaft boring spindles give close and unvarying tolerances essential in mass-producing such parts as transmission housings, pump bodies, and gyro gimbal frames. Rough boring, high-finish boring, counterboring and spot facing operations can all be combined in one by the use of precision cluster spindles, and a workpiece moving between two cluster spindles can be multi-processed on both sides, in perfect register, with only one set-up. Shaft centers in Whitnon cluster spindles can be placed very close together without sacrificing rigidity and ruggedness, by offsetting the pulleys and bearing assemblies. Full assistance and information without obligation.

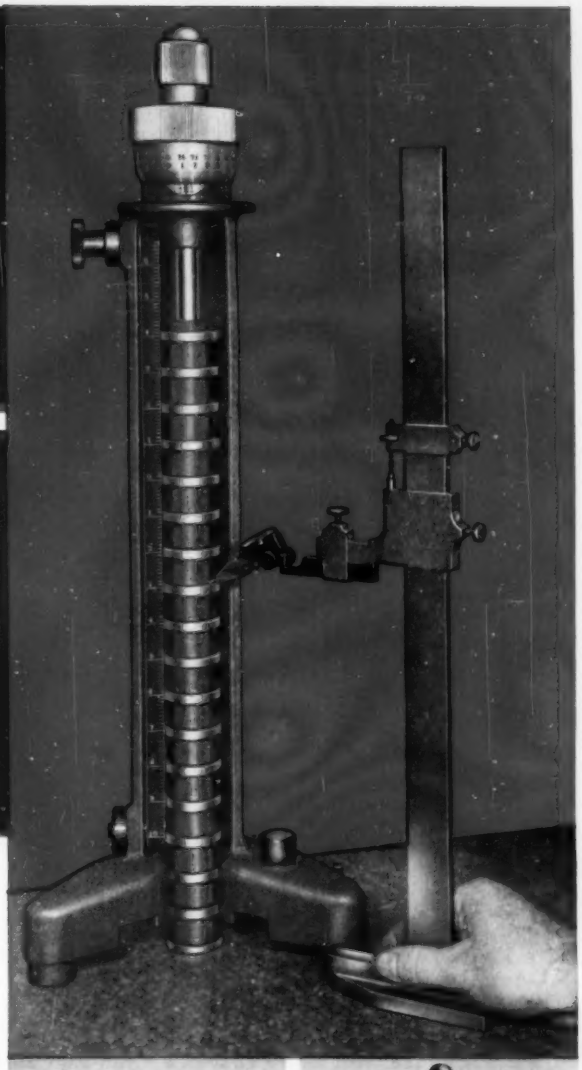
Specialists in the design and manufacture of high-precision spindles for boring, milling, grinding and drilling. Custom builders of precision rotary machinery. Expert repairs for all anti-friction spindles in Farmington and at The Whitnon Spindle Company, 20466 Wyoming Ave., Detroit 21, Mich.

**Whitnon**

*The Whitnon Manufacturing Company,*
*Route 6 and New Britain Ave., Farmington, Conn.*



## See How PLA-CHEK Cuts Inspections from Minutes to Seconds

Notice the wrist light photos above. Just a turn of the Micrometer thimble and PLA-CHEK is set. Far fewer motions, far less time . . . and guaranteed accuracy to .00005″ throughout this PLA-CHEK'S entire range. No gage blocks or reference surfaces to touch—body heat can't affect it. Setting time 10 seconds . . . inspections in 1/5 the time of older methods. That speed and accuracy is being proved daily in thousands of installations throughout industry.

There are many other time-saving and money-saving features of PLA-CHEK Gages. Let us tell you about them. Write for complete, detailed literature.

### COMPLETE RANGE OF SIZES

PLA-CHEK Gages are available in a full range of sizes to meet every inspection or surface plate layout requirement. Models are: The easily portable 6″ and 12″ sizes and the 18″ size (shown above) are guaranteed accurate to .00005″ throughout their entire range, and the 24″, the 36″ and the 48″ sizes are guaranteed accurate to .0001″ in any 24″ length or .0002″ over their entire range.

**PRECISION RISERS**

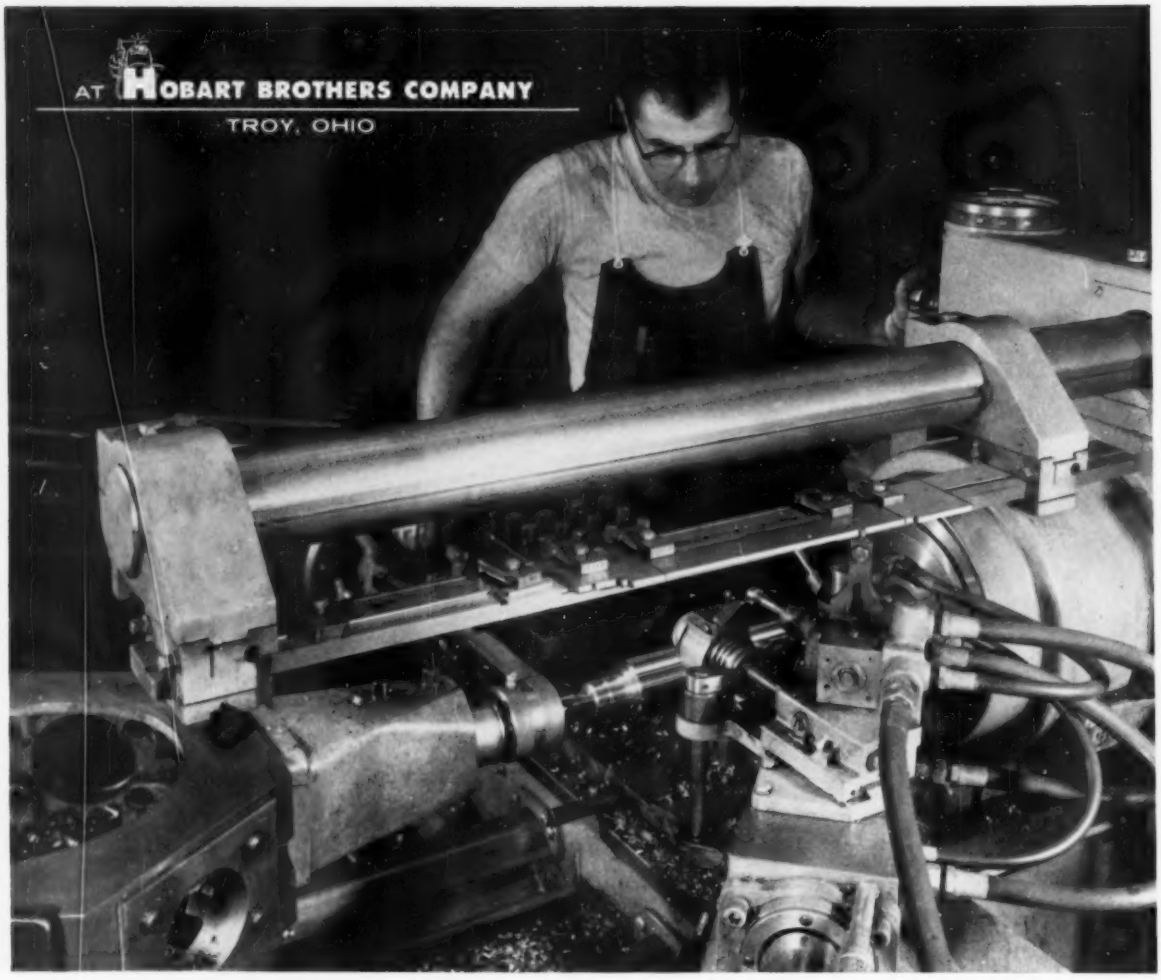
Built with the same precision as the gages themselves, PLA-CHEK Gage Risers may be used to extend the usefulness of every PLA-CHEK Gage from the smallest to the largest size. Available in 6″ height for 6″, 12″, 18″ PLA-CHEKS . . . 12″ height for 24″, 36″, 48″ models.

**MICROMETER THIMBLE**

is graduated to .0001″ and provides dimensions between 1″ steps on measuring bar. Measuring bar of the 18″ model (as illustrated) and larger models, can be adjusted to enable the user to take readings up or down relative to a center line or other reference line on the work.

**Cadillac GAGE COMPANY**

P.O. BOX 3806 • DETROIT 5, MICHIGAN




# Warner & Swasey 2-A with contouring cross slide

***Slashes setup time—from 2 hours to 20 minutes • Combines auxiliary operations into one setup • Produces shafts at 1948 cost levels***

Hobart Brothers Co. faced a serious production bottleneck. Long setup time on their older turret lathes and excessive part handling time was crippling the small lot production of motor-generator shafts. Because their production scheduling for 77 different models of arc welders, 20 models of ground-power units, plus numerous specials, is tied directly to sales, lot sizes frequently had to remain small—usually from 1 to 20 pieces.

Hobart launched a three-pronged attack to solve the problem by:

1. Installation of a new Warner & Swasey 2-A Saddle Type Turret Lathe equipped with a hydraulically-controlled cross slide contour unit.
2. A creative tooling approach to reduce setup time.
3. A thorough time and motion study to insure efficient utilization of daily production time.

As a result, Hobart Brothers today are producing shafts at 1948 production costs!

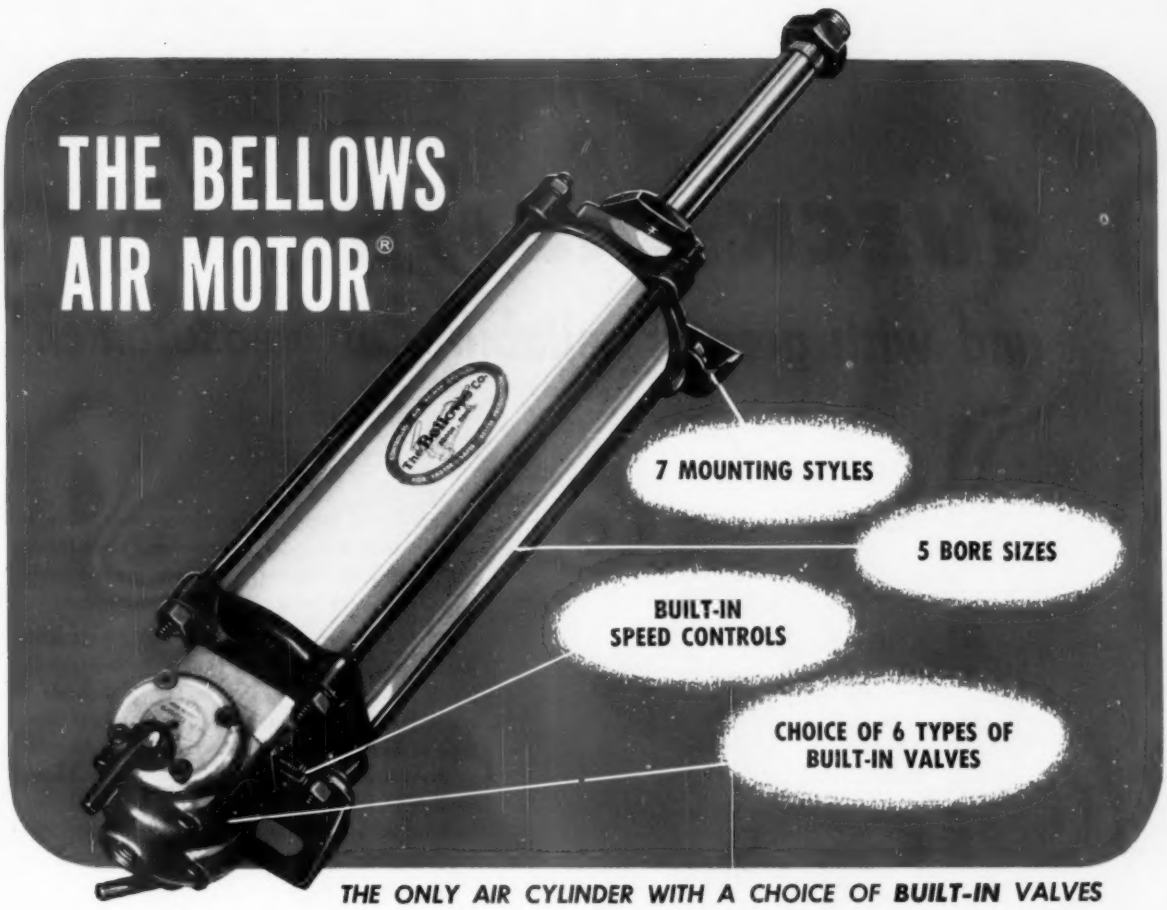
Contributing to the success of this efficiency study and modernization program was their new contour cross slide equipped Warner & Swasey 2-A which also permitted:

- **Combining of center drilling, facing and threading operations into a single, efficient turret lathe setup reducing part handling time.**
- **Production time savings averaging 35% because of higher horsepower and spindle speeds, and elimination of extra hex turret and square turret handling time.**
- **Holding closer tolerances which reduced grinding time and extended grinding wheel life.**

WARNER & SWASEY
*Cleveland*
PRECISION MACHINERY SINCE 1880

**YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY**

# THE BELLOWS AIR MOTOR®




***THE ONLY AIR CYLINDER WITH A CHOICE OF BUILT-IN VALVES***

In designing for air operation, the engineer can choose the method of valving he prefers—and still have all the advantages of integral valve and cylinder construction.

Six different built-in valve arrangements give the engineer every latitude in pneumatic design.

If he prefers to use 8-12 volt electrical control with its simplified wiring, Bellows has it. If he prefers to use 115 volt control and JIC standards, Bellows has it. If he requires low or high voltage explosion-proof control, Bellows has it. Should his design require full pneumatic control, Bellows has it. Or should he wish to control his pneumatic circuits manually or through mechanical linkage or cams, Bellows has it.

Unlike conventional air cylinders which require separate remote directional and speed control valves and dual piping, the Bellows Air Motor is a complete power unit with directional valve and dual speed control valves built-in as an integral part of the unit. Only one air connection, which can be made with flexible hose, is required.

Integral valve and cylinder construction means quick response, more positive response, more precise control and more economical operation.

The Bellows Air Motor is made in five bore sizes: 1¼", 1¾", 2½", 3⅝", and 4½", and in any stroke length.

***WRITE FOR THIS BULLETIN* TODAY!**

Four-color, 20-page bulletin describes the complete line of Bellows Air Motors. Free on request. Address Dept. TE-1259, The Bellows Co., Akron 9, Ohio.

627-C

**The Bellows Co.**

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

**AKRON 9, OHIO**

OTHER INDUSTRIAL DIVISIONS OF IBEC: Sinclair-Collins Valve Co., Valvair, Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio

# CHECK FASTER

## and with greater reliability of measurement

Made in West Germany

CARL ZEISS

## Large Toolmaker's Microscope

This large toolmaker's microscope, made by Carl Zeiss, is a decided improvement over former instruments. It offers greater ease, greater rapidity and greater reliability of measurement.

Has a measuring range of 3x6", permitting extensive application. Its new built-in gauge block displacement device makes it possible to quickly move the stage in the longitudinal direction in five steps and in the transverse direction in two steps, thus eliminating the old fashioned method of interchanging gauge blocks. All manipulations, adjustments and readings are performed from the same position in front of the instrument.

The inclined binocular tube can be tilted and adjusted to suit the convenience of the operator. During tilting, the image in the eyepiece always remains in focus. The object to be tested is seen simultaneously with the cross-line of the protractor. The scale of the protractor and templet, however, can be projected consecutively into the eyepiece.

### BUILT-IN BEAM-SPLITTING DEVICE

Another novel feature of this instrument is the new built-in beam-splitting device with single or double reversed image in complementary colors for line-symmetrical or center-symmetrical measurements.

**A small toolmaker's microscope is also available**

***Write for literature***

**CARL ZEISS, INC.**

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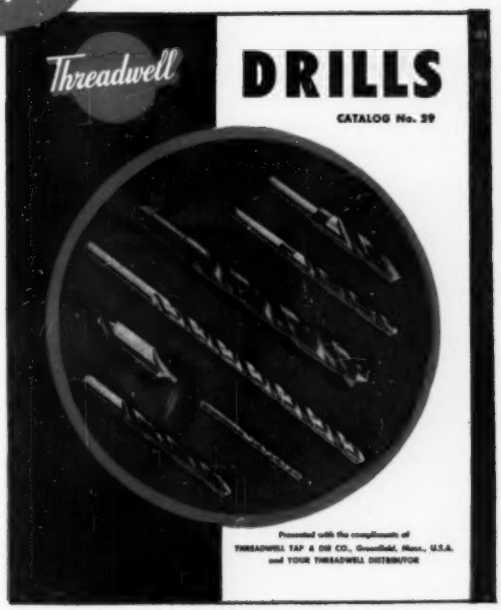
WITH A COMPLETE LINE OF

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# The Day Maximation Began

In seeking ways to increase efficiency, production men in the metalworking industry have found elimination of hidden machine tool costs through the use of proper filtration equipment a virtual guarantee of maximum output and economy. This method of obtaining increased production rates is known as *maximation*. Although today, it is one of the most significant factors in determining metalworking profit ratios, the maximation theory and its initial applications were actually developed more than 20 years ago.

### HOW MAXIMATION STARTED

A number of months after inspection and delivery of several thousand piston rings to an airplane engine plant, the manufacturer was told that the rings were unsatisfactory and would be returned. Metal particles in the coolant apparently had adhered to the rings during the lapping process and the original high polish finish on the inside of the rings was pitted and chipped on removal from storage. About this time, engineers from the U. S. Hoffman Machinery Corp. were pioneering in research and development of dry cleaning principles for the removal of metal from kerosene coolants. Asked to provide a solution to the problem, they designed a pressure filter system for the clarification of coolants.

### THEN AND NOW

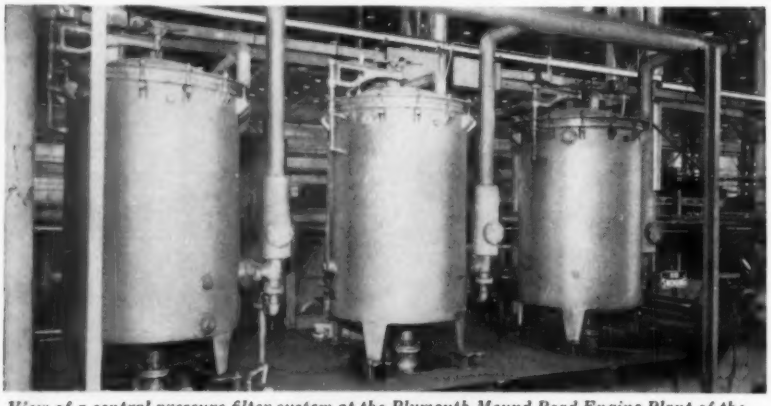
This first filtration equipment by Hoffman was a fantastic complex of pipes and valves. But it did a fine job of bringing clean coolant to the work. A few months later, Fafnir Bearing asked for 2 pressure filters "just like the original." From these pioneering concepts have come Hoffman's modern equipment. Today, Fafnir Bearing employs more than a dozen advanced Hoffman individual and central filtration systems.

At Fafnir and in thousands of other plants employing filtration, coolants and lubricants once contaminated by metallic chips, abrasives and other extraneous dirt are no longer responsible for high production, maintenance and costs, as well as premature obsolesence. Through proper filtration, machines originally designed and tested for peak efficiency with clean lubricating oil and clean coolants can now operate at or near rated capacity. Filtration has made it possible to obtain a 30 to 50% savings in grinding wheels, honing stones, broaches, cutting and other edge tools in addition to providing numerous collateral benefits and advantages.

### TYPES OF FILTRATION EQUIPMENT

In making recommendations for solving filtration problems, Hoffman engineers draw on a complete line of equipment which includes;

PRESSURE FILTERS—This type of filter gives up to 100% clarity and is widely used with grinding, cutting and honing oils as well as water soluble oil coolants where finest clarity is consistently required. Easily adapted for large groups of machines. Unlimited coolant capacity.



*View of a central pressure filter system at the Plymouth Mound Road Engine Plant of the Chrysler Corp. This system serves a wet grinding department.*

FLOTATION EQUIPMENT—Automatic flotation units increase the productivity of machine tools and eliminate down time for sump cleaning. Provide excellent results in steel and cast iron applications with efficiencies of over 98% in one pass. Handles flow rates from 40 to 1500 gpm.

MAGNAFLOW SEPARATORS—Fully automatic and self-cleaning, Hoffman Magnaflo Separators remove from 75% to 90% ferrous solids from cutting oils and water soluble coolants. Flow rate from 40 to 1,000 gpm.

VACU-MATIC FILTERS — For continuous filtering of coolants from *individual* machine tools. Provides unusually high flow rates in continuous filtration of water soluble coolants. Completely automatic and self cleaning. Flow rates range from 40 to 2,500 gpm.

DISC FILTERS — Filter oils containing finely divided particles. Geared for continuous flow.

SUCTION FILTERS—Provide fine filtration on small flow rates for lapping, microhoning, grinding and similar operations. Cap.5-60 gpm.

### SUMMING UP

Proper filtration delivering clean coolant makes it possible to achieve maximation with these savings.

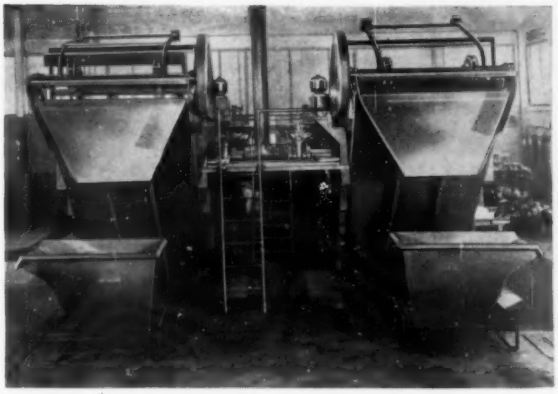
- Greatly reduced down time
- Higher speeds
- Improved finishes—fewer rejects
- Longer useful life of coolants
- Life of edge tools extended
- More sustained tolerances
- Fewer stoppages, adjustments
- Scrap loss considerably reduced
- Elimination of motor pumps
- Curtails bacteria and rancidity
- Saves 25 to 50% in grinding wheels, honing stones, broaches, individual machine tools.

To check on the unlimited industrial applications of individual tool and complete central filtration systems, send for free bulletins and case histories on equipment described above.

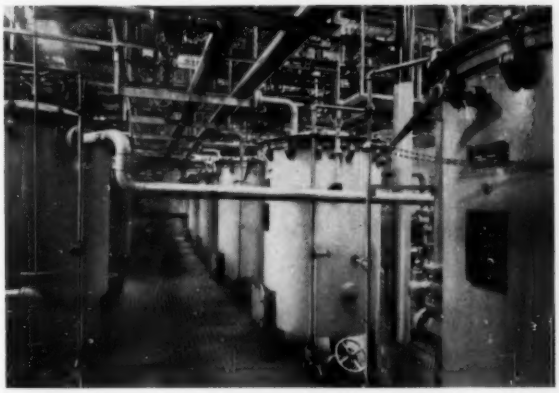
*Please write:*
*U.S. Hoffman Machinery Corp.*
*Dept. LR, Industrial Filtration Div.*
*Thompson Road—Plant #1*
*Syracuse, New York*

Today's high production costs dictate a good hard look at metalworking tools and techniques—make a reduction in operating expenditures essential to increased profit margins. Here are typical examples of companies which have obtained maximum production from machine tools by eliminating unnecessary and often hidden expenses through the use of Hoffman filtration equipment.

# They're Beating High Machine Tool Costs and Obsolesence



*A Hoffman Central Flotation System serving 28 grinding machines at an International Harvester plant. The coolant serving the sickle grinding department is a water-base soluble oil.*



*A Hoffman Central Filtration System consisting of 9 Hoffman Pressure Filters, Model 1-80S, each equipped with Hoffman Dual Magnaflo Plates—with a flow rate of 150 gpm and sludge collector conveyor—(Magnetic separator), are shown at the plant of a leading automotive and aircraft accessory manufacturer.*

This system enabled International Harvester to make the following savings:

Cleaning of coolant trenches completely eliminated —savings of $10,000 annually.

Trucking costs for the removal of sludge to a disposal point reduced 65.5%. Saves $8,122.50 annually.

Cost of grinding wheels reduced 47.4% — saves $65,477.19 annually.

Production per grinding wheel increased 134%.

Cost for wheel-change-over reduced 57.3%.

Adding these and others, the total savings for this particular year were significant.

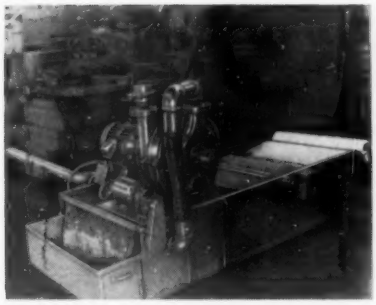
The following tabulation is a percentage breakdown of actual savings made with this Hoffman Central Filtration System equipped with a Magnetic Separator and sludge collector conveyor for automatic removal of sludge collected by filters, magnetic plates and gravity settling.

Grinding Oil 2.5%

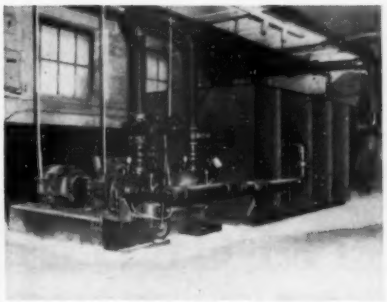
Diamonds—Grinding Wheels 43.4%

Production scrap (resulting from improved quality of product) 32.5%

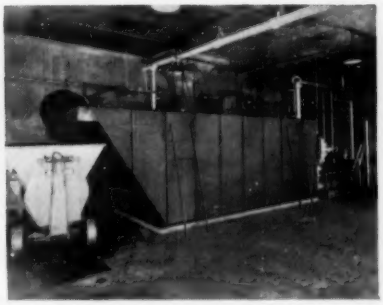
Labor to operate system and actual production labor @ $2.00 per hour 21.6%



*A Hoffman Vac-80 Vacu-Matic Filter is shown installed on a Norton 30" diameter stepped-wheel grinder for grinding transmission shafts at the Syracuse plant of a large automotive manufacturer. Most Norton grinders are equipped with Hoffman Vacu-Matic filters when shipped.*

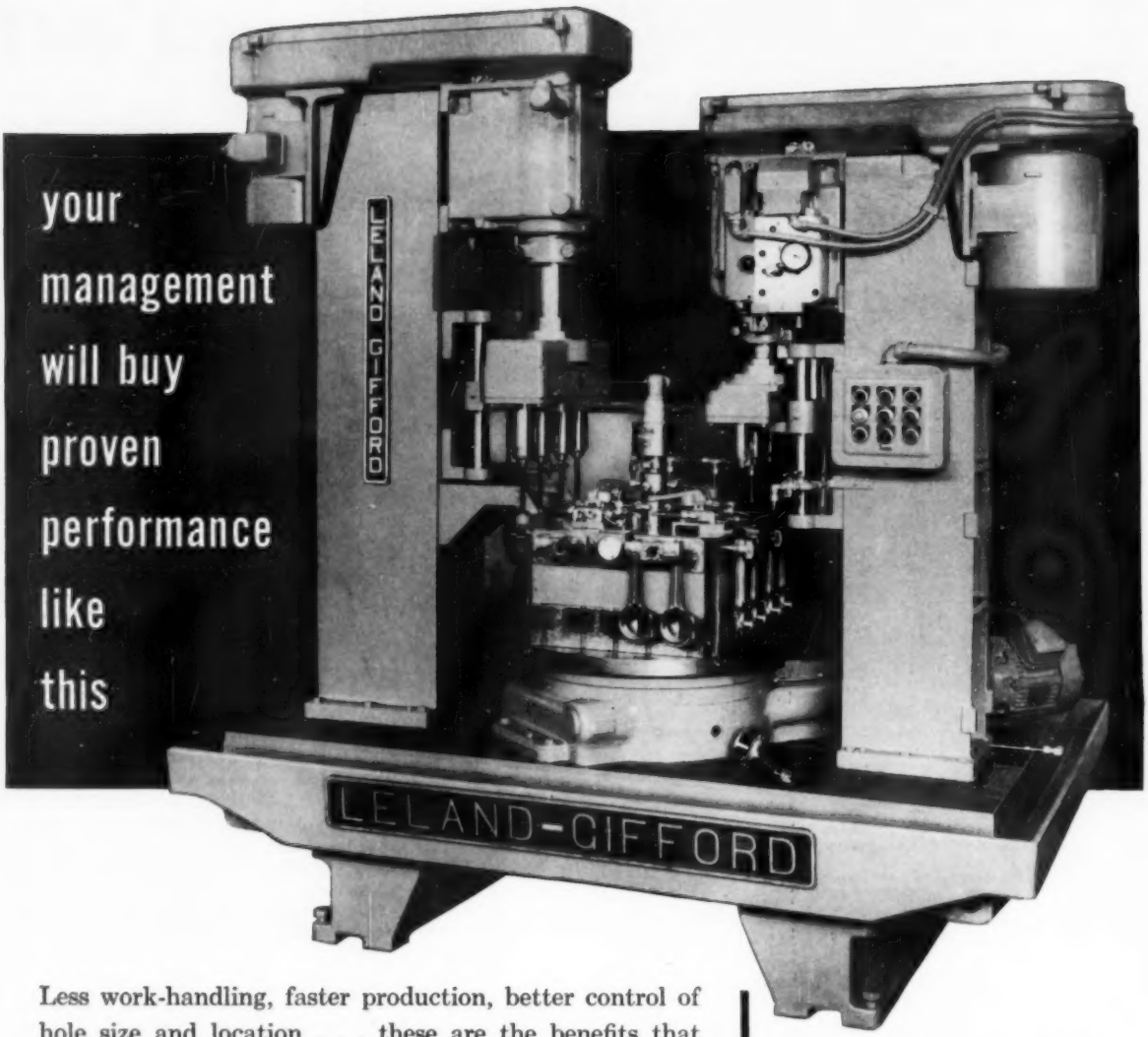


*At the Union Twist Drill Co. in Athol, Massachusetts, a Hoffman Magnaflo Separator removes metal particles from oils and coolants to solve numerous clarification problems. Result—many money-saving improvements in manufacturing technology and product quality.*



*A money-saving Hoffman Flotation Unit at the Fafnir Bearing Company. It is designed for plant wide distribution of water-base coolant. The company credits Hoffman systems for great improvement in critical finish grinding operations on bearing races.*

# your management will buy proven performance like this




Less work-handling, faster production, better control of hole size and location . . . these are the benefits that quickly justify investment in Leland-Gifford special drilling machines. We will gladly work up your rough notes into a fully developed proposal and supply the facts and figures you need to sell management on your suggestions for better precision drilling methods.

***For automatic drilling at its best be sure to see Leland-Gifford***

**CALL THE OFFICE NEAR YOU**

**THE JOB:** Drill ½" oil splash hole and 3/16" metering hole in connecting rod.

**THE MACHINE:** A Leland-Gifford two-unit special with one No. 4 and one No. 3 self-contained drilling unit. Index table is loaded with four parts in each station and clamped by hydraulic clamp cylinders. Four-spindle multiple head at left station drills splash holes to depth; directed air jets at rear station clear chips, four-spindle head at right station drills metering holes. Production of 620 pieces per hour is easy at 100% efficiency.

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USE READER SERVICE CARD, CIRCLE 23

USE READER SERVICE CARD, CIRCLE 24

*New* CINCINNATI *210-6, the "Handy Andy" of the Centuramic line. Cost-reducing extra equipment: Vari-Pitch Infeed Attachment, micrometer handwheel, profile regulating wheel truing.*

# Centuramic

## THE NEW LINE OF CINCINNATI CENTERLESS GRINDING MACHINES

THE MOST PROMINENT NAME in centerless grinding is Cincinnati, and the newest name in CINCINNATI FILMATIC Centerless Grinders is Centuramic. Over 35 years ago, Cincinnati pioneered the low-cost centerless method, building machines and devising equipment for precision grinding every conceivable type of part, from tiny dental drills to 18-foot steel bars . . . and other shapes and materials such as bowling balls, surgical sutures, reinforced glass fishing rods, rubber grommets. Cincinnati brought the cost advantages of precision centerless grinding to shops in every type of industry.

*Operation and setup of the new 210-6 Centuramic are convenient from both front and rear. (Rear controls extra)*

Now Cincinnati introduces the Centuramic line of five new Centerless Grinders. These new machines produce higher quality work than ever before, and at such low cost that they become doubly attractive for replacement or expansion programs. Centuramic Centerless Grinders are *cleaner and more convenient* to operate, *quicker* to set up.

Complete information on the 210-6, the versatile job shop member of the line, is outlined in a new catalog, No. G-728. A copy will be sent on request. **Grinding Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CENTRIC • ROLL • CHUCKING • CENTERLESS LAPPING

**CINCINNATI®**

GRINDING MACHINE DIVISION

Close-up of TOCCO Work Station for heating rivets.

Rivets are heated to 1900° F. in just 15½ seconds.

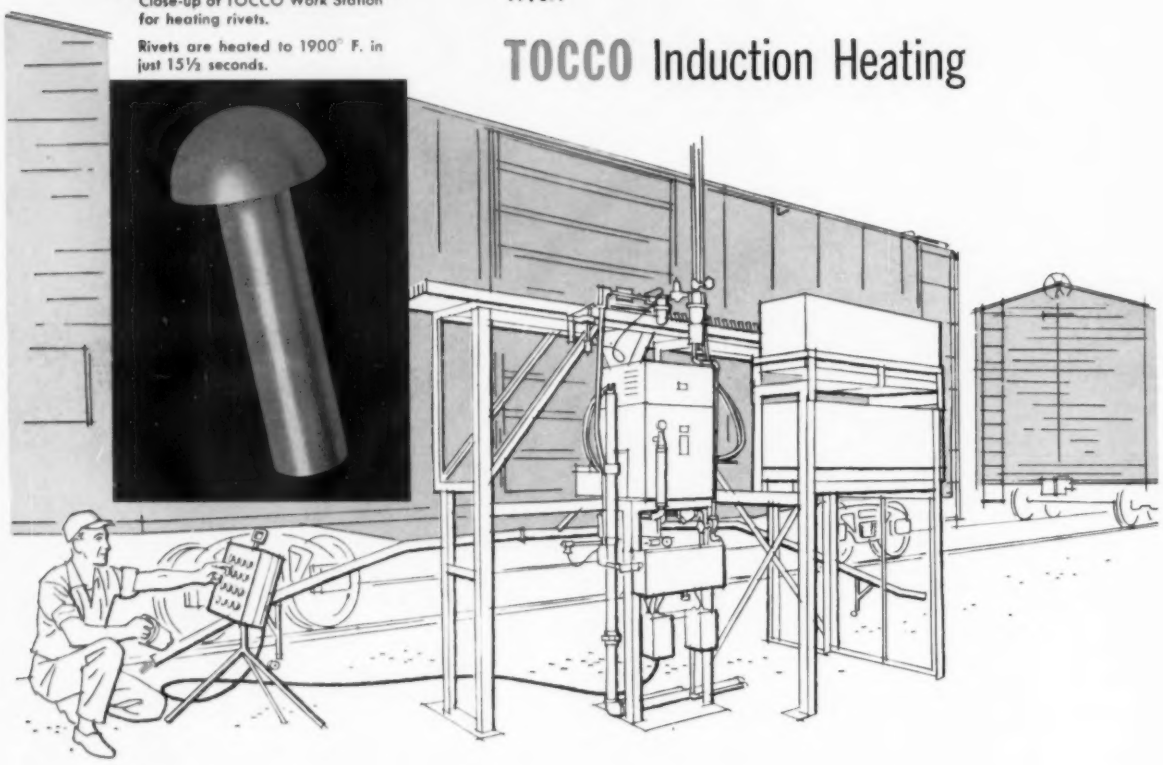
## How a Major Railroad Saves

# OVER $17,000 PER YEAR

## with

## TOCCO Induction Heating





Rivets are delivered to the riveter at the right temperature, at the right time, and of the right size. This headwaiter for rivet-hungry box cars is a TOCCO Induction Heating Unit with ingenious tooling that selects the proper one of 10 sizes of rivets and shoots it to the riveter in seconds.

**Savings in Labor**—User reports a whopping labor savings of 6240 man hours per year since installing TOCCO.

**Savings in Fuel**—$1,500 is saved in fuel alone since the switch from an old-fashioned oil furnace.

**Savings in Maintenance**—Hundreds of dollars per year saved in maintenance costs since installing TOCCO.

**Savings in Time**—Formerly, riveters had to wait for rivets to get hot. Now there is no waiting time.

If you are seeking ways to speed production and lower costs, look to TOCCO for economical heating for forging, heat-treating, or brazing.

JUST PUSH A BUTTON

**TOCCO**

**THE OHIO CRANKSHAFT COMPANY**

***Mail Coupon Today***—NEW FREE Bulletin

**The Ohio Crankshaft Co. • Dept. G-12, Cleveland 5, Ohio**

Please send copy of "Typical Results of TOCCO Induction Heating for Forming and Forging."

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## Desire

Invention and organization are inseparable twins of manufacturing success. Divided they are useless and progress is slow and halting. When they are joined, the way to the future becomes sure and rewarding.

We must have the desire to mix these ingredients of success with proper exactness and speed if we wish to paint a profitable picture. It matters not whether you are the owner, manager, department head, designer, planner or draftsman. Your part in the over-all results of a project will leave an effect just as a cup of white lead in a gallon of black paint will alter its shade.

To be sure, one of the most difficult of all management problems is to create and maintain the desire within the hearts of the whole team to do a job faster, better, more often, and ultimately with less fuss and expense. Desire is a mood and must be stimulated by new formulas, goals and excitements. We cannot allow ourselves the luxury of becoming satisfied with what we have or what we are doing without standing in one place while the world goes whizzing by.

We must continue in our desire to do more, to speed things up, to beat competition, to make a better product, to be a better product and to encourage others while we are practicing.

Discuss a new approach to a problem with someone on the team until you both have the desire to change the method. The results will be beneficial and gratifying. A great series of pleasures will result when we learn how to make a challenge from problems and how to treat their solutions as accomplishments rather than jobs.

To find the true meaning of and the formula for DESIRE is the wish I have for you this Holiday Season.

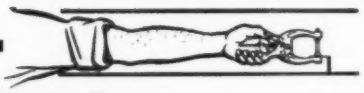
May you and yours have success and many pleasures in the years ahead.

Wayne Ewing

**PRESIDENT**
*American Society of Tool Engineers*

NEW 2-WAY
TRIGGER RELEASE
Model 462 illustrates how only one hand easily releases clamp by pressing trigger toward either handle. This patented feature available on many De-Sta-Co Portables.

# IF YOU CAN REACH IT— A DE-STA-CO Portable Will Clamp It!

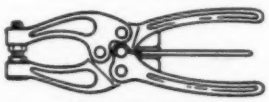


Hundreds—yes, thousands—of awkward clamping problems have been brought to us for solution in our 40 years of leadership. Many of these have been solved by De-Sta-Co Portable Clamps. You now have a selection of two dozen basic models, a variety which masters almost any conceivable portable, blind or awkward clamping operation. To add to the versatility of all our portables, there's a complete line of accessories. Features which may aid you in your next problem are

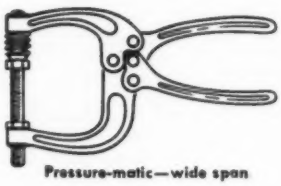
1. ***Two way trigger releases*** **on numerous models**
2. ***Deep jaws and wide spans***
3. ***Flexi-matic and Pressure-matic spindle adjustments***
4. ***Non-magnetic materials*** **for the special application**
5. ***Light weight models*** **for continuous frequent handling**

Compact models

Self-adjusting models



Deep jaw models



Pressure-matic—wide span

De-Sta-Co Portables lend themselves to special adaptations for that "insurmountable" problem.

Standard portables offer jaw openings ½″ to 6″, throat depths to 3½″, pressures from 35 lb. to 1200 lb.

Send for the De-Sta-Co catalog with details on over 130 types, sizes and models of portable and *fixture* clamps. We'll send you the name of our stocking distributor in your area. He is ready and qualified to assist you with your clamping problem.

*De-Sta-Co is widely known for toggle clamps, stampings, precision washers, spacers, shims, shim and feeler stock, blower housings and marine specialties.*

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**DETROIT STAMPING COMPANY**

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# engineering

# road to managerial competence

**By John A. Ritchey**
Associate Professor
Industrial Engineering
Purdue University
Lafayette, Ind.

**Management—the accomplishment of goals through others—requires technical competence as well as ability to plan and direct. Engineers who have learned to apply the principles of effective management are needed by industry.**

"MANAGEMENT" AND "MANAGER" are two of the most popular words in industry today. Everyone strives to become a manager—at least in title. Company after company has dropped the titles of foreman, superintendent and the like in favor of titles such as department manager, plant manager and section manager. The increasing use of the word manager is beginning to rival words like "automation" and "operations research."

The modernization of job titles is, of course, desirable. But, if a person is to be called a manager, he should be a manager. The term management can be defined as the accomplishment of goals through others. This is a short definition and one that may sound simple. Nevertheless, many people—particularly those holding managerial positions—do not understand the full meaning and implications of this definition for themselves and their companies.

**True managers develop lists of goals that their departments must reach.**

Goals must be established before anyone can work toward their accomplishment. Here is where many managers are lacking. They work from day to day and supervise the activities of subordinates from day to day but are not certain what their objectives are. General statements such as "making money" or "maintaining good relations" are often mentioned as goals but these are not always satisfactory as statements of objectives for a company or for a department within that company.

**Management Objectives**

Objectives should be specific, down to earth and understandable by all concerned. A tool engineering department, for example, could have an objective related to planning a new production line by a certain time. A production control department could have objectives related to inventories of stock or raw materials for the same production line.

The nature of the statement of objectives for a specific department will, of course, depend on the type of work. Irrespective of the work performed, a manager cannot manage in the true sense unless he develops, either by himself or with his boss, a list of goals that he and his department are attempting to reach. Occasionally it is difficult to develop statements of objectives that are satisfactory to all, but the exercise of thinking about objectives and trying to develop meaningful statements is usually beneficial.

The next part of the definition of "manager" includes the words "through others." A one-man organization has no need for these words in its managerial definition. One man manages only himself and all he needs to do is accomplish the goals he sets for himself. With more people in the organization, however, it is necessary for someone to act as a manager. Since he can't accomplish goals by himself, he must use the services of the others in the organization.

The way in which he uses those services often denotes the difference between a true manager and one in title only. A true manager recognizes that he can do relatively little himself to accomplish goals. Instead he will have to rely on his subordinates. He must provide the necessary leadership, inspiration and motivation to these subordinates, and he must communicate understanding of the goals set.

To illustrate the point, some plant managers go out in the plant from time to time to help the "boys" get out work since, as they put it, "the boys don't know how to do the work properly." Obviously, such managers belong to the "to get a thing done right, you have to do it yourself" school. It is also obvious that some time spent training the boys would probably pay handsome dividends in the long run. Good management is not merely the art of passing the buck to others. Successful managers make maximum use of the abilities and talents of subordinates in order to reach the desired and established goals.

To summarize, a true manager causes things to happen so that planned goals are reached. He does not simply preside over his group as the years go by and then hope that everything will turn out all right in the end. He knows how things will turn out because he is planning and directing activities so that they will turn out as desired.

Managerial competence is achieved when one follows this concept of a true manager. There are many people who have the word manager in their job titles and who think of themselves as managers but who simply enjoy the prestige of the title without accepting any of the managerial responsibilities that

A manager provides leadership, inspiration and motivation to his team.

go with it. One cannot achieve managerial competence by sitting behind a mahogany desk or eating in the executive dining room.

### Technical Competence

Technical competence is essential to sound management. There is no such thing as a "pure" manager—by which is meant an expert in the art and science of management who can apply this skill to any activity, whether it be an army, a baseball team or a candy factory. Certainly there are some basic fundamentals of management that are applicable to all fields. In the final analysis, however, one cannot manage in a vacuum. Each manager works in some special type of activity and it is essential that he have technical competence in that field.

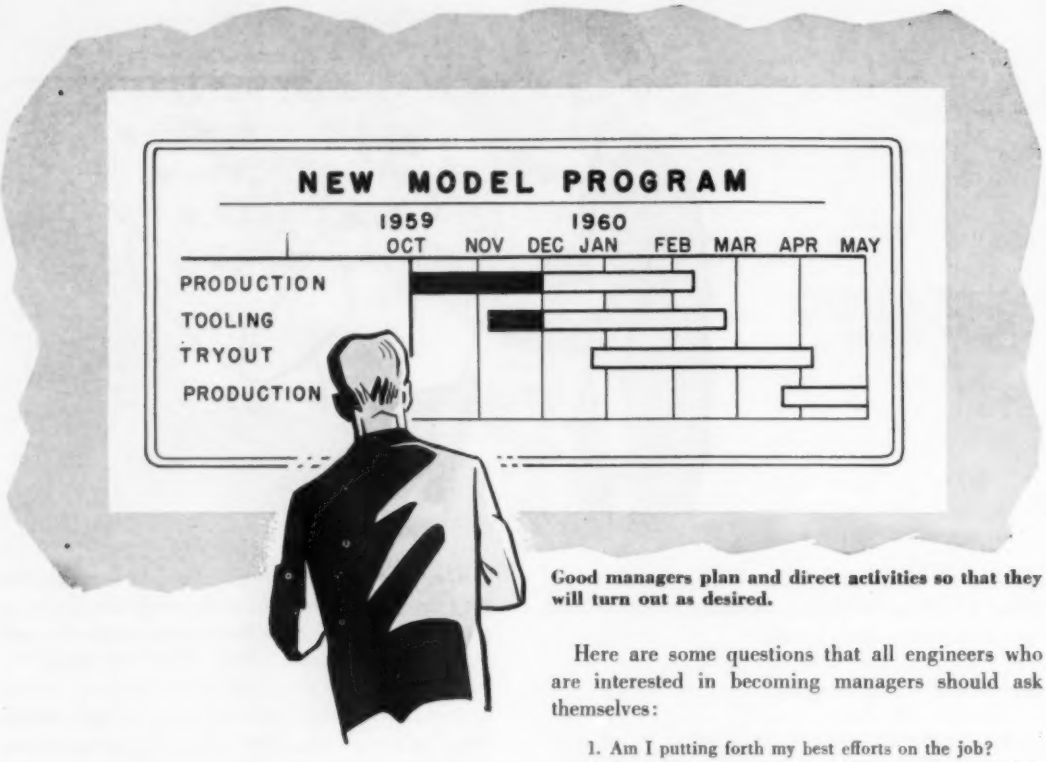
Here is where engineers enter the picture, particularly in the field of manufacturing. Trained engineers are, at least potentially, experts in the technical phases of manufacturing. Most young engineering graduates have been equipped with technical tools, namely the basic tools of mathematics, physics and chemistry. They have been taught the practical application of these tools to systems used in industry. They have been taught how to analyze problems and develop solutions. They have been taught to apply their thinking to the problems of tomorrow. Newly graduated engineers do not all measure up to this rather idealized picture, of course, but the fact remains that they have the background to become technically competent so far as plant operations are concerned, even though at the outset they are unfamiliar with specific plant operations.

Once this potential has been realized through training and experience—when an individual engineer has become technically competent—then he is ready to develop managerial competence.

The trouble with many engineers, however, is that they are not willing to work hard enough or to spend enough time on technical jobs to develop real technical competence. They constantly look for short cuts to win the position of manager without acquiring real technical know-how. Yet without this technical competence they will never be successful.

The term "engineer," like the term "manager," is defined differently by different companies. It is common to call everyone who works in an engineering department an engineer, even though many of the

Good managers make maximum use of the abilities and talents of subordinates to accomplish goals.




**Good managers plan and direct activities so that they will turn out as desired.**

people in the department have never had formal engineering training. As often as not, men who set time standards are not trained engineers. In many instances they don't need to be trained engineers and, in fact, it is often a mistake to put trained engineers on such jobs.

An engineering degree is not, in itself, a guarantee of potential or actual technical competence. Many nonengineers do excellent jobs in engineering departments. The fact remains, however, that manufacturing processes are becoming so complex that most companies today count on gaining their technical competence by hiring graduate engineers.

Ideally, such engineers should have training in the areas of process design, production control, quality control, systems design, methods and standards, tool design, quantitative methods, and many other areas. Rigorous training in mathematics, physics, chemistry, statistics, engineering science, and such disciplines as electrical, chemical and mechanical engineering provides the background for broad understanding of these specialized studies.

### Becoming a Manager

Again, it is emphasized that an engineering degree is not the only road to technical competence and therefore the only road to managerial competence. It is a good road, however, to managerial positions in manufacturing plants.

Here are some questions that all engineers who are interested in becoming managers should ask themselves:

1. Am I putting forth my best efforts on the job?
2. Am I doing everything possible to qualify myself to do even better technical work in the future?
3. Do I tend to shy away from highly technical engineering problems with the thought that I am more the "managerial" type?

Some sound advice to such engineers is to tackle the hardest jobs—be the best engineer they can—and attain every bit of technical competence they can. They will have then earned advancement.

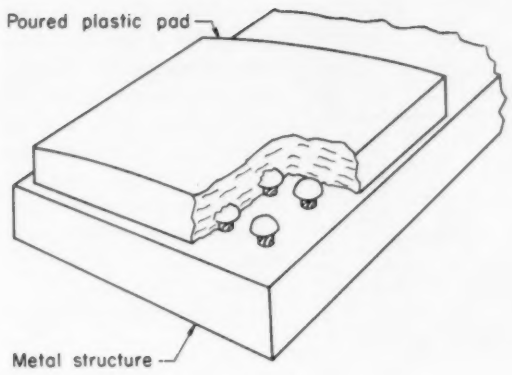
Those who are already managers should ask themselves this question: Am I a true manager and not just someone who is enjoying the prestige of the title? A little thought on the meaning of true management, particularly with an open mind, will pay dividends.

A further point about managers: One of their responsibilities is to hire and train employees to handle the many assignments that are involved in manufacturing. These positions are probably filled at present but, as the years go by, replacements will be necessary and new jobs will be created. To the extent that these jobs require technical ability, they should be filled by qualified engineers.

After these engineers are on the job, it is a managerial responsibility to help them learn, help them develop and help them attain technical competence. Once this competence is attained, they should be given an opportunity to move ahead into managerial positions. The responsibility of a manager includes the development of managers, as well as the development of technically competent engineers.

# Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work




## Holding Plastics Pads

Plastics pads and inserts can be quickly and economically locked to metal "rough" tooling. A series of holes are drilled in the metal structure. Screws are then driven into the holes with a hammer. Tapping operations are not necessary. The screw heads project ¼ to ½ inch above the plate.

After all screws are installed, the plastics is poured into place. When it hardens, it is permanently locked in position on the screw heads.

For most jobs, $\frac{3}{16}$-inch and ¼-inch screws are used. The No. 6 and 8 sizes work equally well in areas where space is limited.

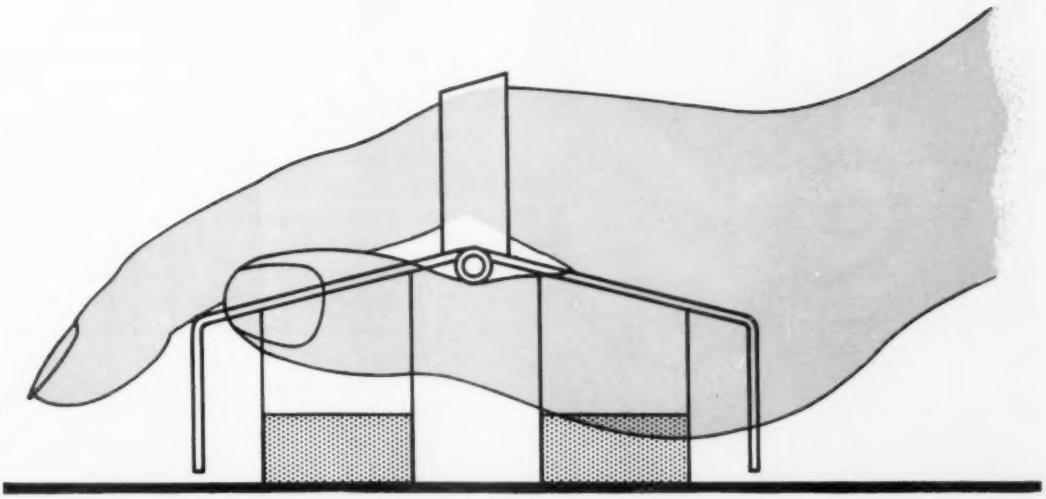
*D. R. Gates*
*North Texas Chapter*

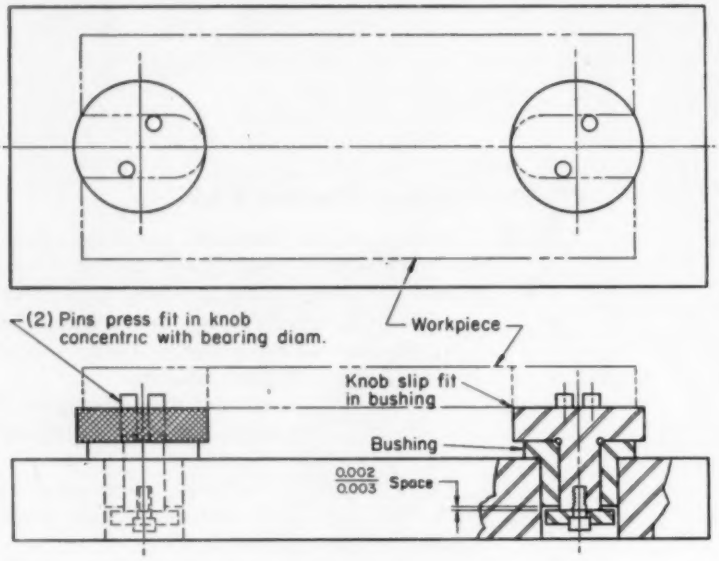
## Magnetic Sheet Lifter

Made from a strap hinge, two wood blocks and two magnets, the sheet lifter illustrated is suitable for handling thin sheets of metal. The wood blocks are fastened to the hinge with screws and the magnets are cemented to the blocks. A strap holds the device onto the operator's hand. To release the lifter from the sheet, the operator closes his hand and the ends of the hinge force the magnets away from the sheet. The device is the correct size to fit the hand.

*William Martin*
*Brooklyn, N. Y.*

**LAST CHANCE!**
**Gadgets contest closes December 31. See list of cash prizes and other details elsewhere in this issue.**



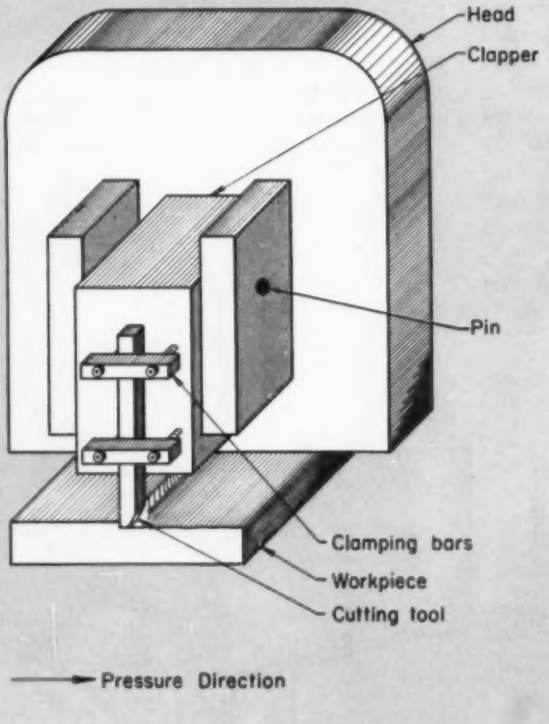



## Centering Fixture

The gadget illustrated is used for centering slotted workpieces. It may be used for gaging or for jigs or fixtures. When used for gaging, the device rests on one side on a surface plate and the top surface of the workpiece is checked with an indicator.

For use in machining operations appropriate clamps are added.

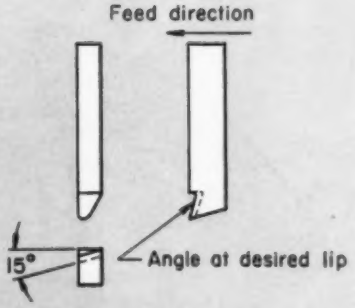
*Robert M. Dickson*
*Springfield (Mass.) Chapter*

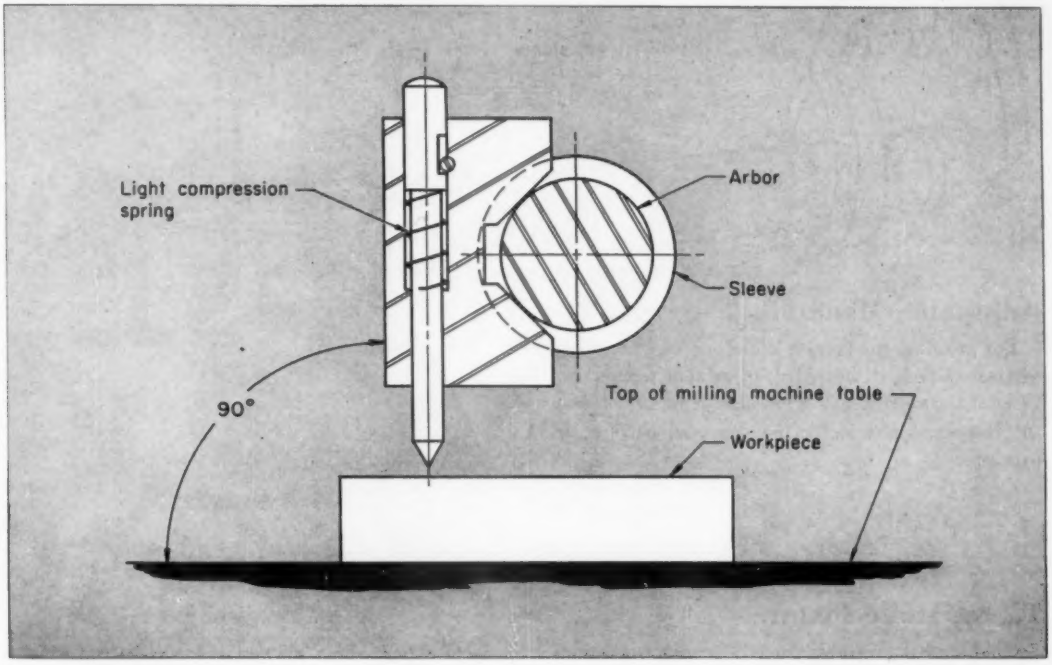



## Planer Tool

When a planer or shaper clapper box becomes loose because of wear on the retaining pin, the cut can become inconsistent or uneven and tools may have a tendency to dig into the work. Repair may be required at an inopportune time. A tool ground with a back rake of 15 degrees as shown forces the tool in a direction opposite to the direction of the cut. The cutting edge is then in the same position each time, since the slack is taken up before the tool begins the cut.

*John M. Breen*
*Pittsburgh Chapter*






## Spotting Punch

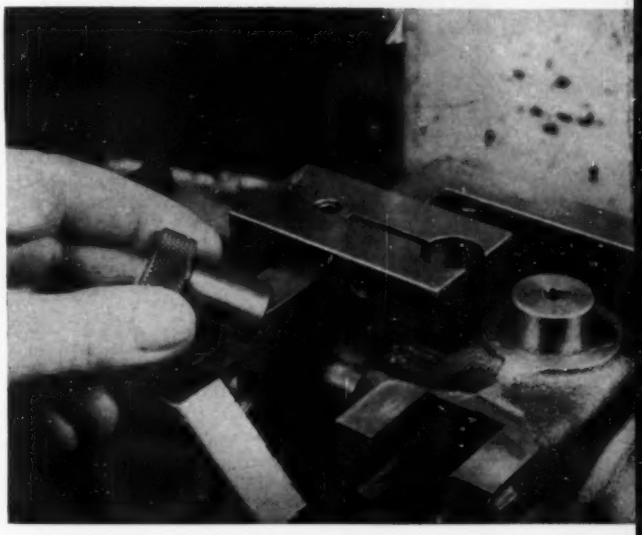
Convenient for laying out hole centers, the spotting punch illustrated is used with the graduated dials on milling machine feedscrews. A V-block which is clamped to the machine arbor holds the punch. The side of the block opposite the vee is made flat and parallel to the punch. It is used as the locating surface. When setting the tool, the spindle is locked and the tool set at right angles to the table. It is then clamped between collars or sleeves on the arbor. When using the punch, it is set over a previously located starting point and the table is located at new positions by means of the machine dials.

*F. Murray*
*Chicago, Ill.*

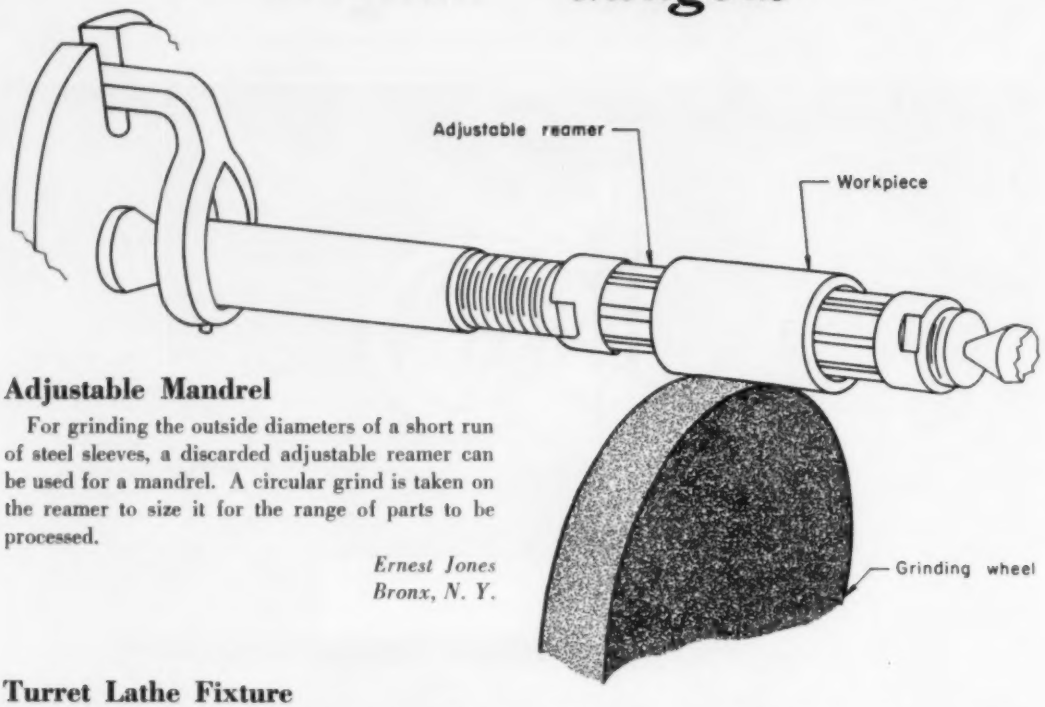
## Bushing Support

Sometimes it is difficult to locate a drill bushing in a jig because a protruding portion of the workpiece prevents enough extension of the jig plate to completely contain a hole large enough for a liner and slip bushing. This was the case in the box jig illustrated. To solve the problem a slotted bushing plate was used, with the bushing hole partially cut away. Because it was not possible to make the hole large enough for a liner, the plate itself was made of tool steel, hardened and ground on all important surfaces. The slot, extended back from the bushing hole, permits adjustment for proper bushing fit. A capscrew is used to draw the plate together when adjustment is necessary. Two slip renewable bushings are seated alternately in this hold for drill and ream operations.

*H. J. Gerber*
*Member-at-Large*



# Gadgets




## Adjustable Mandrel

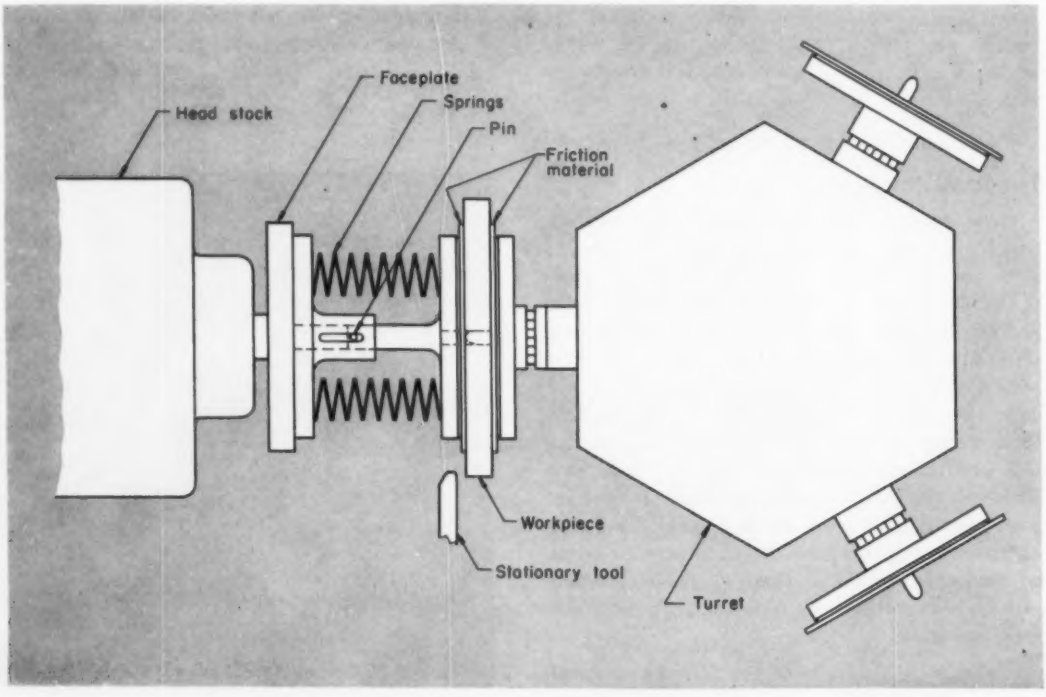
For grinding the outside diameters of a short run of steel sleeves, a discarded adjustable reamer can be used for a mandrel. A circular grind is taken on the reamer to size it for the range of parts to be processed.

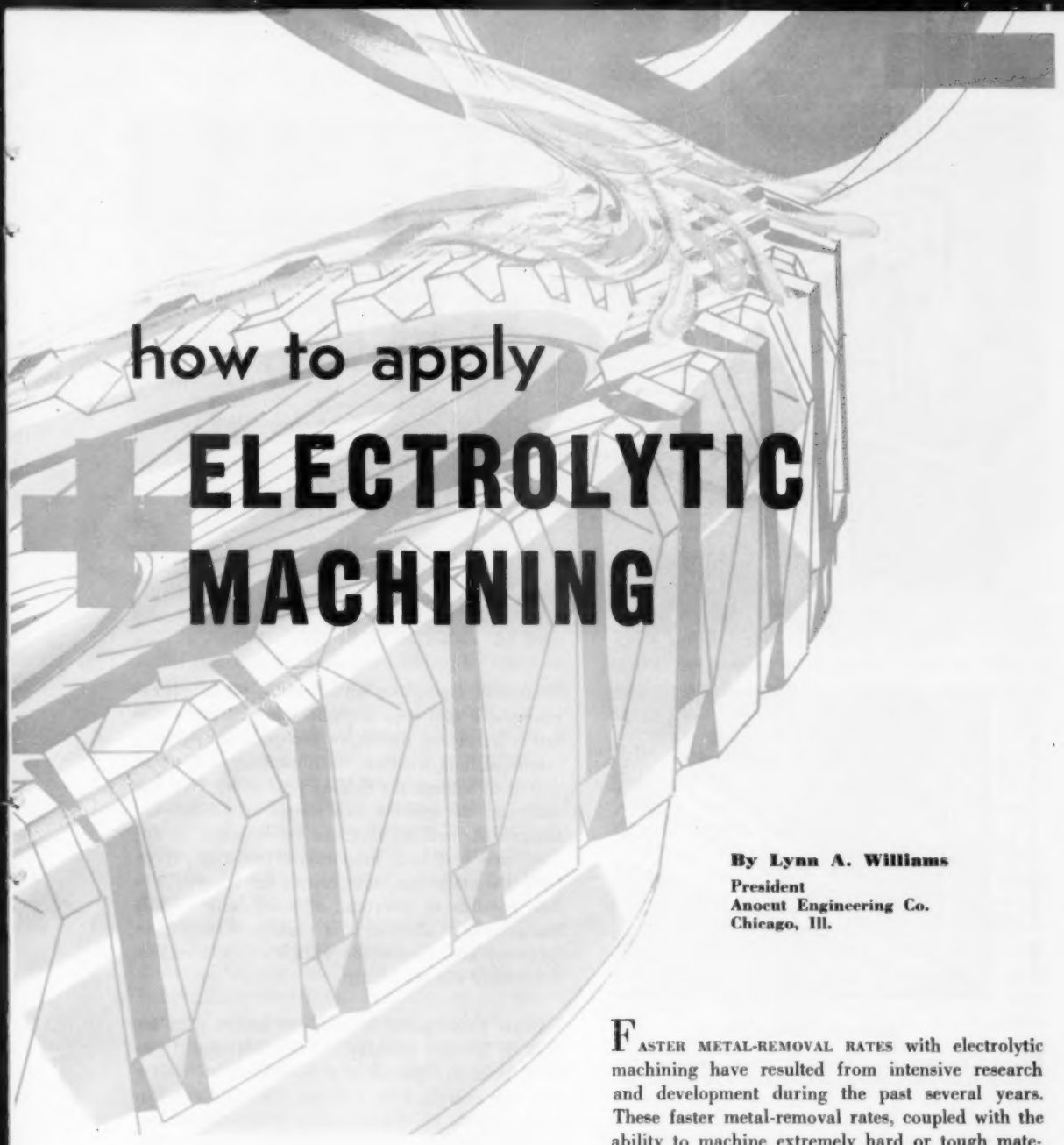
*Ernest Jones*
*Bronx, N. Y.*

## Turret Lathe Fixture

Holding disks securely for OD turning operations can be difficult. In the fixture illustrated, the workpiece is securely held by spring pressure between two clamping disks faced with friction material. Construction features of the fixture are evident from the drawing. This method provides strong clamping and eliminates the tendency of thin disks to flex or bend during turning.

*H. Koslow*
*Bronx, N. Y.*





# how to apply ELECTROLYTIC MACHINING

**By Lynn A. Williams**
**President**
**Anocut Engineering Co.**
**Chicago, Ill.**

**Although electrolytic machining methods are relatively new, they have already made important contributions to American manufacturing efficiency. This process can now be used for internal, as well as external, work. Tool engineers who are interested in applying the electrolytic machining process in their own plants will find ample data in this article by a recognized authority.**

FASTER METAL-REMOVAL RATES with electrolytic machining have resulted from intensive research and development during the past several years. These faster metal-removal rates, coupled with the ability to machine extremely hard or tough materials, have resulted in a host of new applications. The ability to machine material that is susceptible to thermal damage and the absence of burrs in electrolytically machined parts are also of interest to tool engineers.

Electrolytic machining or grinding, electrochemical machining or grinding, and anodic machining or grinding are all names for the same phenomenon —removal of metal by electric current flow, *Fig.* 1. They should not be confused with electrodischarge or spark-arc machining methods.

While the principle of metal removal which underlies electrolytic machining may seen strange, it is entirely governed by laws of physics that are well understood. Accordingly, the performance of

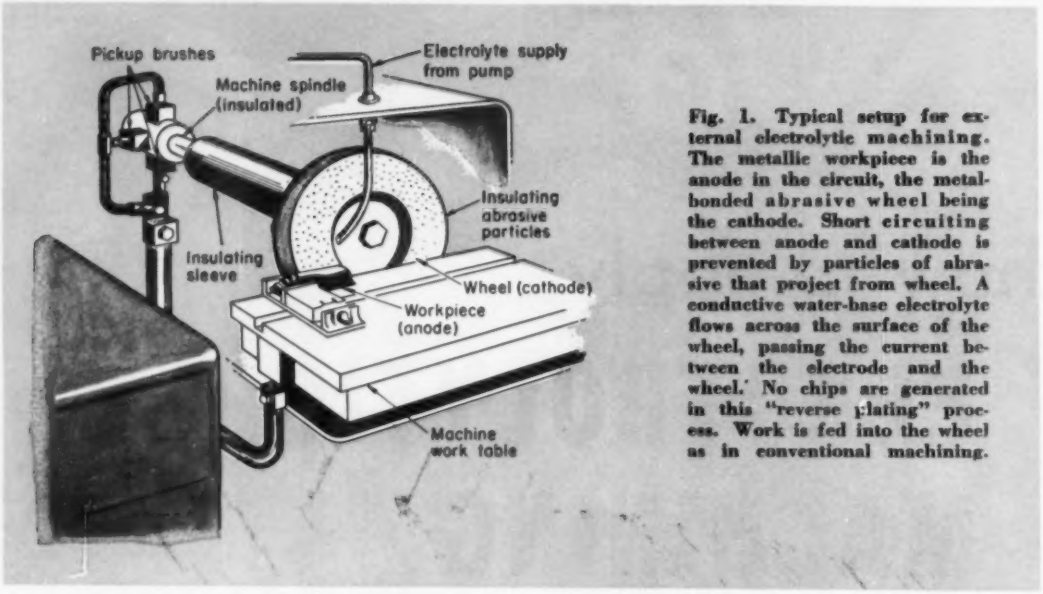



**Fig. 1. Typical setup for external electrolytic machining. The metallic workpiece is the anode in the circuit, the metal-bonded abrasive wheel being the cathode. Short circuiting between anode and cathode is prevented by particles of abrasive that project from wheel. A conductive water-base electrolyte flows across the surface of the wheel, passing the current between the electrode and the wheel. No chips are generated in this "reverse plating" process. Work is fed into the wheel as in conventional machining.**

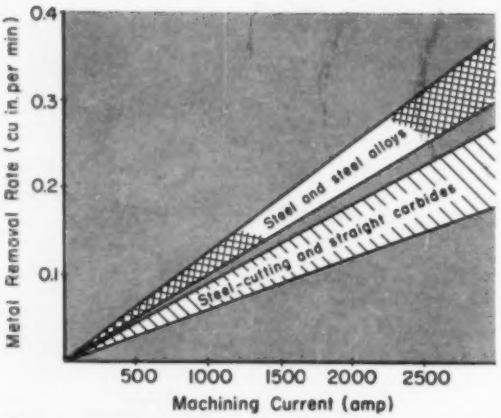



**Fig. 2. Ranges of volumetric metal removal for steels and carbides. Removal increases with amperage.**

**Electrochemical Equivalents of Industrial Metals**

| Work Material | Removal Rate* |
|---|---|
| Aluminum | 0.128 |
| Beryllium | 0.094 |
| Chromium | 0.137 |
| Cobalt | 0.125 |
| Columbium | 0.205 |
| Copper | 0.134 |
| Iron | 0.134 |
| Molybdenum | 0.119 |
| Nickel | 0.125 |
| Tantalum | 0.103 |
| Titanium | 0.133 |
| Tungsten | 0.121 |
| Zirconium | 0.133 |

*Cu in. of metal removed per 1000 amp min.

electrolytic machining can be readily predicted. For example, a tool engineer who wants to know how fast a particular workpiece can be electrolytically machined, and what electrical capacity will be required to achieve the desired production rate, can determine the answers with simple arithmetic. The amount of material that can be removed in any given time is directly proportional to the amperage. Once the amperage requirements are known, it is then possible to ascertain, although with slightly less accuracy, whether it is possible to apply the necessary amperage to the work over the area that is available for machining.

**Basic Principles:** It has been known since the work of Michael Faraday (1791-1867) that if two metal poles are placed in a conductive electrolyte bath and energized by a direct current, metal can be plated onto the negative pole (the cathode) and deplated from the positive pole (the anode). The cathodic side of the process is extensively used, of course, in electroplating. The anodic side of the process, where metal is removed instead of being added, had not been used at all for industrial metal-working until the advent of the electrolytic machining process. It is, however, a potent force for metal removal, and may with time become as useful as the plating or cathode side of the Faraday cell. The problem is to put the principle to work so that the anodic action can be localized and speeded up and so that dimensional accuracy can be achieved.

Faraday established not only the basic idea of electrolysis, but also the rule that the amount of metal deposited on the cathode or deplated from

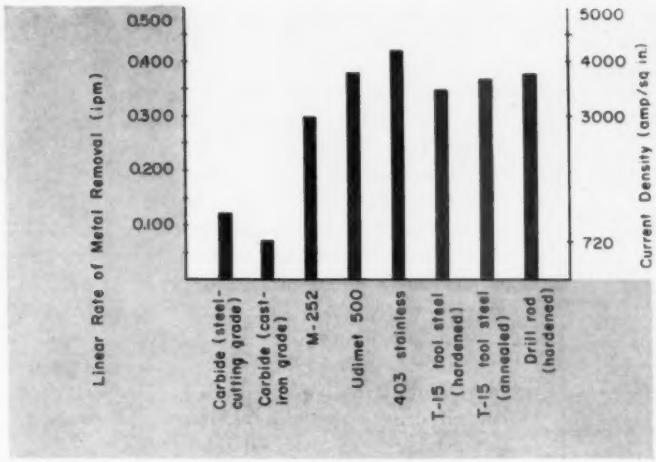



**Fig. 3. Linear metal removal rate per minute for one-half-inch-diameter rods plunged into wheel face.**

**Fig. 4. Cone-face wheel establishes large work area. Feed is perpendicular to face of this page.**

the anode is directly proportional to the current used in electrolytic action on the metals. So basic is this idea that the ampere is defined by reference to it: An ampere is that amount of current which when flowing for one second will deposit (or deplate) 0.001118 gram of silver. This number is called the electrochemical equivalent of silver.

Every other metal has its own electrochemical equivalent; that is, for a given current a fixed quantity of metal will be removed. Since current is the only factor in Faraday's law, it is easy to estimate the current or amperage required for a given rate of removal.

Ordinarily, the electrochemical equivalents, as they are called, are expressed in grams per ampere. These values are not handy for the engineer in industrial metalworking. Accordingly, the accompanying table has been prepared to show the theoretical maximum removal rates for a number of common industrial metals, expressed in cubic inches per 1000 amperes.

No tool engineer should make any plans in which he assumes or hopes for metal-removal rates (in relation to current supply) above these theoretical maximum levels. To do so is like putting five horsepower into one end of a shaft and hoping to get seven or ten horsepower out of the other end. As a matter of fact, even the theoretical maximum values cannot be realized in practice, as will be explained more fully.

**Metal-Removal Rates:** As the table shows, the electrochemical removal rates of many common alloying metals—chromium, cobalt, iron, molybdenum, nickel, tungsten—are closely bracketed. In practice the variations among different alloys can be neglected in computing electrolytic removal rates, despite the fact that the mechanical properties of the alloys may be different when various kinds and amounts of alloying material are used.

It is not possible to go directly from the table of electrochemical equivalents to the solution of a machining problem. This is because the values shown in the table are theoretical maximum values at 100 percent current efficiency; that is, under a condition where all of the current is used for metal removal, none being lost in heat or in liberation of gas from the electrolyte.

In electrolytic machining, however, the current efficiency is remarkably high, ranging from about 75 percent to over 90 percent, depending on the material, the electrolyte and the work configuration. These values are computed after measuring and making allowance for the relatively small amount of material removed by abrasion. These high values are surprising because many electroplating baths necessarily operate at much lower current efficiencies. It might be expected that with the high current densities used in the electrolytic machining the current efficiency would be lower, instead of higher, than with ordinary plating baths.

As a practical matter, it is usually safe to assume a removal rate of 0.100 cubic inch per minute for each 1000 amperes of current, *Fig.* 2. This value is applicable to most steel materials and to most so-called "superalloys" of the high temperature type. For tungsten carbide the values range from 0.100 cubic inch per minute for some of the newer steel-cutting grades to values which may range as low as 0.060 cubic inch per minute for each 1000 amperes for some of the "straight" carbides with low cobalt content. Accordingly, the figures given may be regarded as conservative for steel and superalloys but should not be used in computing removal rates for tungsten carbide without first checking the particular grade or grades to be machined.

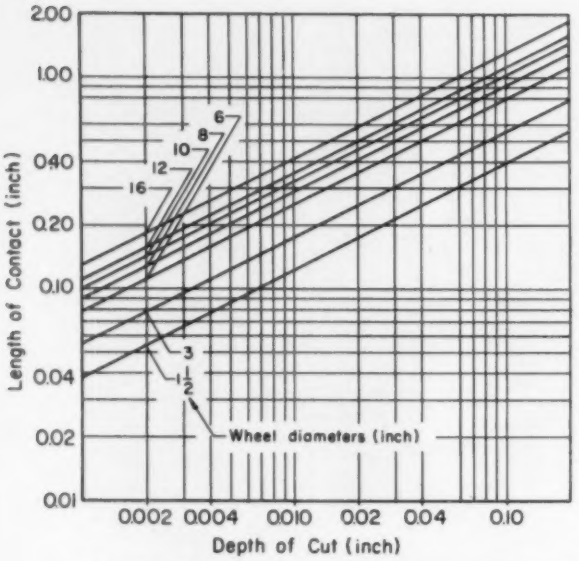



**Fig. 5. Chart for determining contact length of grinding wheels. Maximum contact speeds work.**

Each material, *Fig.* 3, will pass a different amount of electrolytic current, depending on its chemical characteristics. Removal rate is determined by this factor, not by hardness or other physical characteristics.

The first step in analyzing a job for electrolytic machining is to compute the volume of material to be removed and, knowing the time cycle desired, arrive at the required electric current. For example: suppose a surface of high-alloy steel 1 x 2 inches in area is to be machined to a depth of 0.060 inch in one minute. The total volume of material is 0.120 cubic inch (1 x 2 x 0.060 inch). If 1000 amperes will remove 0.100 cubic inch per minute, then 1.2 times that amount of current, or 1200 amperes, will be required to do the job in one minute. There is no escape from this requirement. The job can't be done in one minute with 30 amperes or 300 or 600 amperes. On the other hand, if it were desired to do the job twice as fast, twice as much current, or 2400 amperes, would be required. It is because the current is the controlling factor in metal removal that electrolytic machining power supply units are rated in amperes of output rather than in volts or watts, which might be appropriate for some other use of electricity.

**Current Density:** The second step in analyzing any job for electrolytic machining is to ascertain how (and whether) the necessary amount of current can be applied for the desired rate of removal. Here, two kinds of considerations apply. The first is the attainable current density, and the second is the available work area.

Current density is simply the amount of electric current that can be passed to a given work area. In plating tanks, this relationship is expressed in amperes per decimeter or amperes per square foot. It is common, for example, to operate a plating bath well below a maximum of 300 amperes per square foot. For electrolytic machining, the current densities are much higher; higher, in fact, than theoretically predicted maximum limits. Many electrolytic machining installations operate at 144,000 amperes per square foot (1000 amperes per square inch) and much higher current densities are frequently used. For practical application to most metalworking jobs, it is more convenient to express this relationship in amperes per square inch. Ordinarily, it is desirable to use the highest current density that can reasonably be attained; this maximizes the removal rate.

The principal factors affecting the maximum attainable current density are the characteristics of the work metal, the electrolyte and the wheel. If it is not possible to increase current density merely by increasing the applied voltage without limit. At too high a voltage the electrolyte breaks down and may cause arcing or it may simply use up current in decomposing the electrolyte. Careful voltage control in the power supply unit is important to the results.

The principal factors in establishing current density are thus determined by the work material and the over-all electrolytic system. For many metals the usable levels now range from 1000 amperes to 3000 amperes per square inch of work area. In laboratory experiments, current densities above 6000 amperes have been observed.

Ordinarily, it is safe to assume that a current density of 1000 amperes per square inch can be obtained. Since it is often possible to obtain higher levels, no job should be ruled out as too slow on the basis of 1000 amperes per square inch. The particular work configuration may permit current densities several times higher with proportionately increased speed of the operation.

**Contact Areas:** The current density, while it is important, is fundamentally a problem of the manufacturer of the equipment, not of the user, and the tool engineer must, unless he is to embark on a long and costly research program, regard the available current density as part of his fixed working data. What he can do, however, is to arrange the work in such a way as to maximize the work area, *Figs.* 4 and 5. Here there is wide opportunity for the exercise of ingenuity—and, with it, a requirement for setting aside many habits of thinking associated with conventional machining.

Consider the example, previously proposed, of a 1 x 2-inch workpiece having a required cut depth of 0.060 inch. There are several ways of arranging the work. In *Fig.* 6a, the work is presented to a

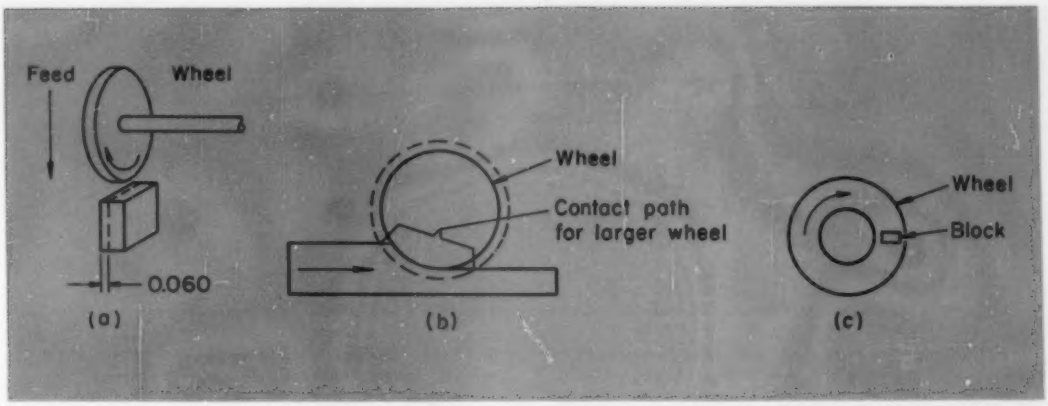



**Fig. 6. The most efficient method for electrolytically machining a small block is to present the largest possible contact arc. Minimum contact arc is obtained with setup *a*; maximum contact arc is with setup *c*.**

wheel so that the edge of the wheel engages the edge of the part and is moved downward across the piece in its long direction.

While this form of shear grinding is not uncommon in conventional grinding, it is virtually hopeless for electrolytic machining because the effective contact area is so narrow, being only 0.060 inch wide. If the other dimension of the contact area is 1 inch (the width of the workpiece) or a little more, say 1.250 inch because of the arcuate wheel shape, then the total area is 1.250 x 0.060 inch or 0.075 square inch. Even if a current density of 300 amperes per square inch is attainable, the total current will be only 225 amperes as compared with a requirement of 1200 amperes to do the job in one minute. With this work configuration, the job cannot be done in one minute but will require over five times as long.

If the job is set up in the familiar peripheral surface grinder arrangement, the available work area is increased by taking deep cuts. In *Fig.* 6b, this arrangement is shown with the depth of cut exaggerated to illustrate the contact path along the wheel. Notice that the contact path is longer (for a given depth of cut) if the wheel size is increased, and is shorter if a smaller wheel is used.

The contact paths of wheels of different diameters are shown in *Fig.* 5. If a 10-inch-diameter wheel is used, the contact path will be 0.78 inch in length with a cut depth of 0.060 inch. Then the work area through which electric current may pass will be 0.78 inch in length and 1 inch in width (the width of the workpiece) or a total area of 0.78 square inch. With this work area, it may be possible to pass the desired 1200 amperes if a current density of 1538 amperes per square inch can be attained. It is now possible—almost—to do the job in the time required. Actually, some improvement is necessary, because, as the wheel first touches the work and as it leaves, the full contact area is not available.

There is, however, a simple way of doing the job which assures success with a wide margin. The piece is simply pressed against the disk face of a wheel, as in *Fig.* 6c. Here the work area is two square inches and 1200 amperes can be passed at a current density of only 600 amperes per square inch, which ordinarily is easily attainable. It is simple to do the job in one minute with this arrangement, while it would be impossible with that of *Fig.* 6a and marginal with the arrangement shown in *Fig.* 6b.

The plunge grind against the disk surface is mechanically simple to arrange but seems unorthodox by conventional standards, and with good reason. If this were attempted with conventional grinding, two problems might be encountered. First, the large contact area might cause excessive heating of the work and loading of the wheel, and second, the wear of the grinding wheel might be uneven, requiring frequent dressing to maintain flatness of the work surface. In electrolytic machining, little heat is generated, and no problems of work

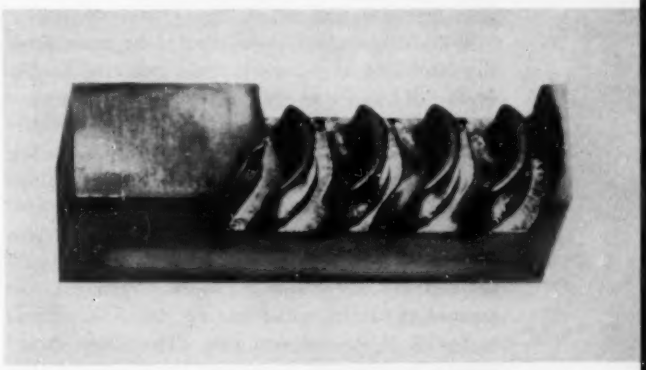


**Fig. 7. Electrolytic cavity sinking machine was used to cut these airfoil configurations from a solid block of superalloy material.**

**Fig. 8. Tool at left cut longitudinal holes through a superalloy cylinder. Tool is hollow. Electrolyte is pumped through tool at high pressure during machining. Tool does not rotate during cutting. Workpiece has been sectioned to show straightness of the hole.**

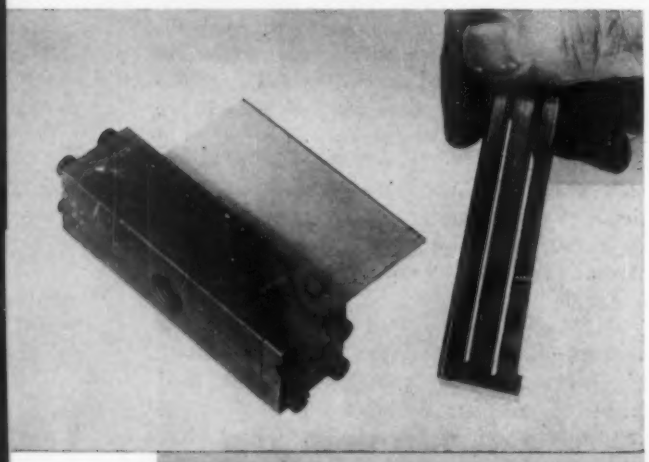


**Fig. 9. Slotting tool and slotted workpiece.**

damage arise. There is so little wheel wear that thousands of pieces may be made without measurable change in flatness.

There is one other observation to be made about the placement of the work. Still referring to *Fig.* 6c, it will be noticed that the workpiece is mounted so that its long dimension is located in a generally radial direction and its short dimension is in line with the path of wheel motion. The reason for this is that unless special provisions are made for feeding electrolyte into the work area there is a loss of electrolyte effectiveness along the work path between the wheel and the work. Therefore, the amount of current which can be passed is reduced and with it the removal rate. The work should always be arranged to present the shorter dimension along the path of wheel motion. If this path length cannot be held below one inch, special provisions for auxiliary feeding of electrolyte into the work area should be made.

For cylindrical machining of both inside and outside diameters, special developments (the subject of patent applications) have been made and should be considered with the equipment manufacturer. Conventional work and wheel arrangements for cylindrical machining ordinarily do not yield good results in electrolytic machining.

Frequently the wheel can be tapered to a conical face for machining flat surfaces that cannot be reached effectively by either a simple peripheral wheel or a flat disk wheel, *Fig.* 4. The cone angle permits establishing a large work area in situations where this might otherwise be difficult.

To summarize: A job can be analyzed, at least in a tentative manner, by first determining the volume of metal to be removed in a given time and then by ascertaining whether the work area can be so arranged as to permit passing the desired amount of current within the limits of reasonably attainable current density.

Sometimes the problem arises in a little different way. The question may arise, "How fast can this job be done by electrolytic machining?" Here all that it is necessary to know is the available area which can be subjected to anodic action and the maximum feasible current density. Referring once more to the example of the 1 x 2-inch piece with a cut depth of 0.060 inch, the available work area is two square inches. If the maximum feasible current density for this metal is 1500 amperes per square inch, then the total maximum current that can be applied will be 3000 amperes, and 0.300 cubic inch of metal per minute can be removed. Since it is assumed that only 0.060 inch in depth (0.120 cubic inches), is to be removed, the job can be done in 120/300 minutes, or 24 seconds. If it were possible to achieve a current density twice

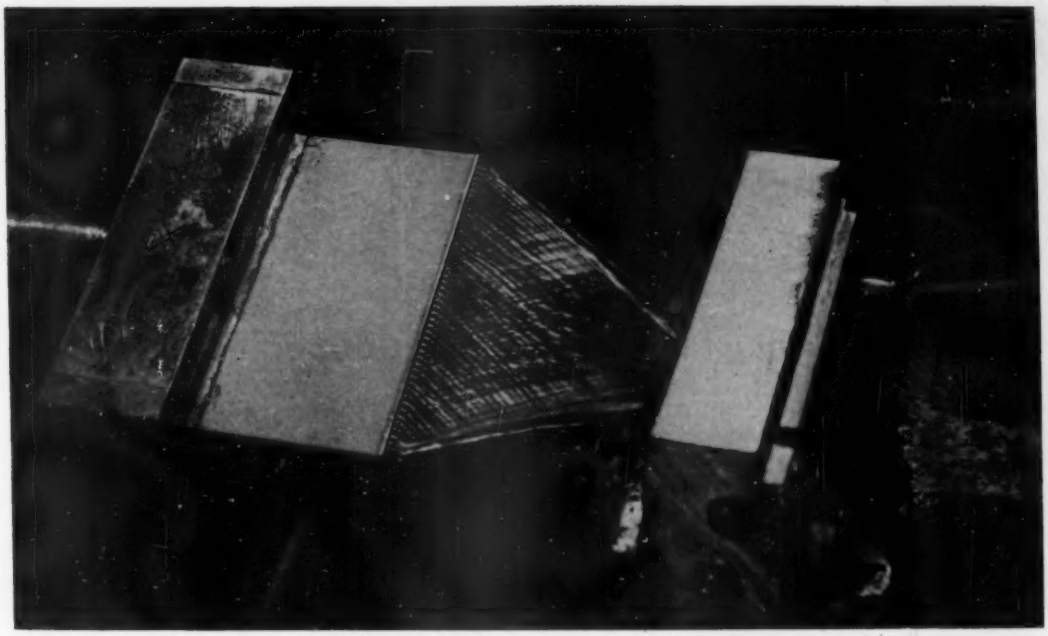


**Fig. 10. Slotting tool prior to starting cut in workpiece at right. Coolant passes through numerous tiny tubes in tool.**

as great, the job could be done in 12 seconds.

The writer was once asked to assist in computing the requirements for machining a steel wing spar some 60 feet long which had to be machined to an average depth of 0.150 inch. The job was to be done "as fast as possible." As it turned out, the job could be done in about 90 seconds—with 720,000 amperes of current! A year's production could have been accomplished in one working day, and the equipment would have stood idle most of the time, absorbing substantial depreciation charges and doing no work. The speed of electrolytic machining should always be balanced to other machining facilities and to production requirements.

**Cavity Sinking:** For the past four years, extensive research has been conducted to develop methods for electrolytic cavity sinking. A special machine for internal work is illustrated in the "Designed for Production" department of this issue of THE TOOL ENGINEER.

Previously, it has been impossible to do internal work electrolytically because of the difficulty of maintaining an adequate supply of electrolyte at the tool-work interfaces. This problem has been solved by providing passages for the flow of electrolyte in the tool itself. The fluid is pumped through the tool at high pressures—150 psi for a typical job.

Metal-removal rates depend on the amperage used. With a 300-ampere power supply, the removal rate is 0.030 cubic inch per minute; with a 3000 ampere power supply the removal rate is 0.300 cubic inch per minute. Ordinarily, the total removal potential can be concentrated in a small work area, permitting high penetration rates. It is normally easy, for example, to concentrate a removal rate of 0.100 cubic inch per minute over a work area (electrode area) of one square inch. In consequence, linear penetration rates range from 0.001 to 0.005 inch per second. If the power supply is large enough, two or more electrodes can be mounted to permit machining several cavities.

On most materials, finishes of 30 to 40 microinches are readily obtainable. Optimum finishes are obtained at maximum removal rates. The smallest size holes that can be machined are 0.050 inch in diameter or slot width.

With electrodes of appropriate shape, virtually any cavity configuration can be machined—round, hexagonal, slotted, even a typical airfoil configuration, *Fig.* 7. A tool for drilling a long hole in a superalloy material is shown in *Fig.* 8. A slotting tool is shown in *Figs.* 9 and 10.

While the process could possibly be used for die sinking, it is felt that its major field of application for the immediate future will be in performing work that cannot be accomplished by other processes. "Drilling" of holes—at comparatively high rates of speed—in the superalloys and tungsten carbides is one example. The ability to machine extremely hard materials at economic speeds should enable product designers to utilize these materials much more effectively in the future. They are no longer a machining problem.

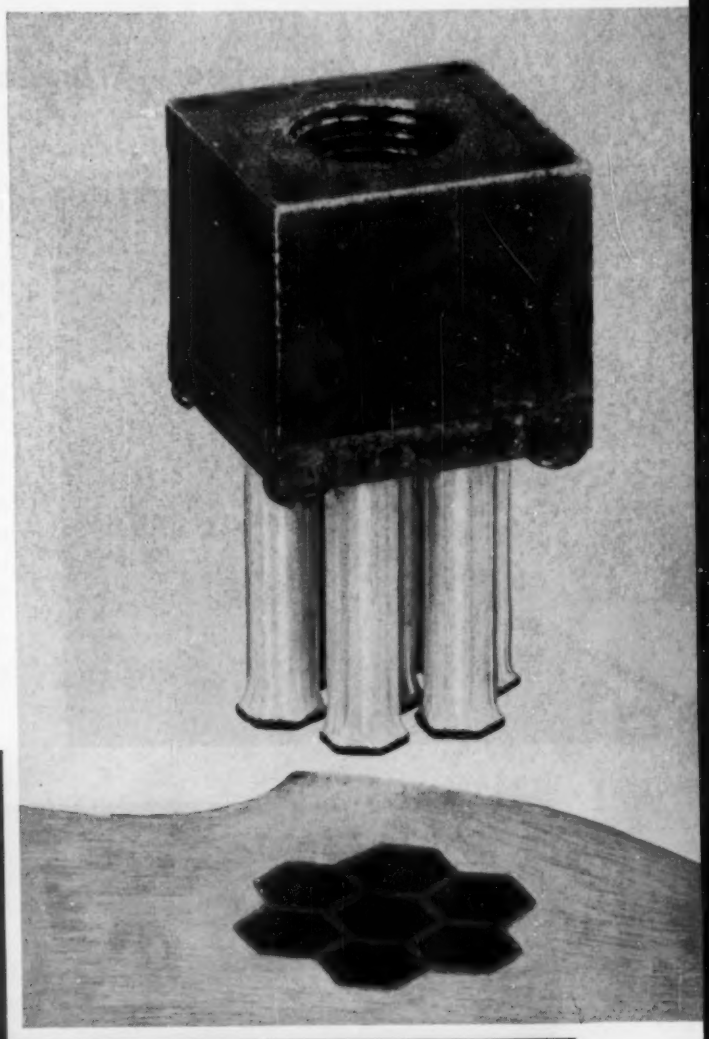
*designed for*

# PRODUCTION

## Machine Sinks Cavities in Superalloys

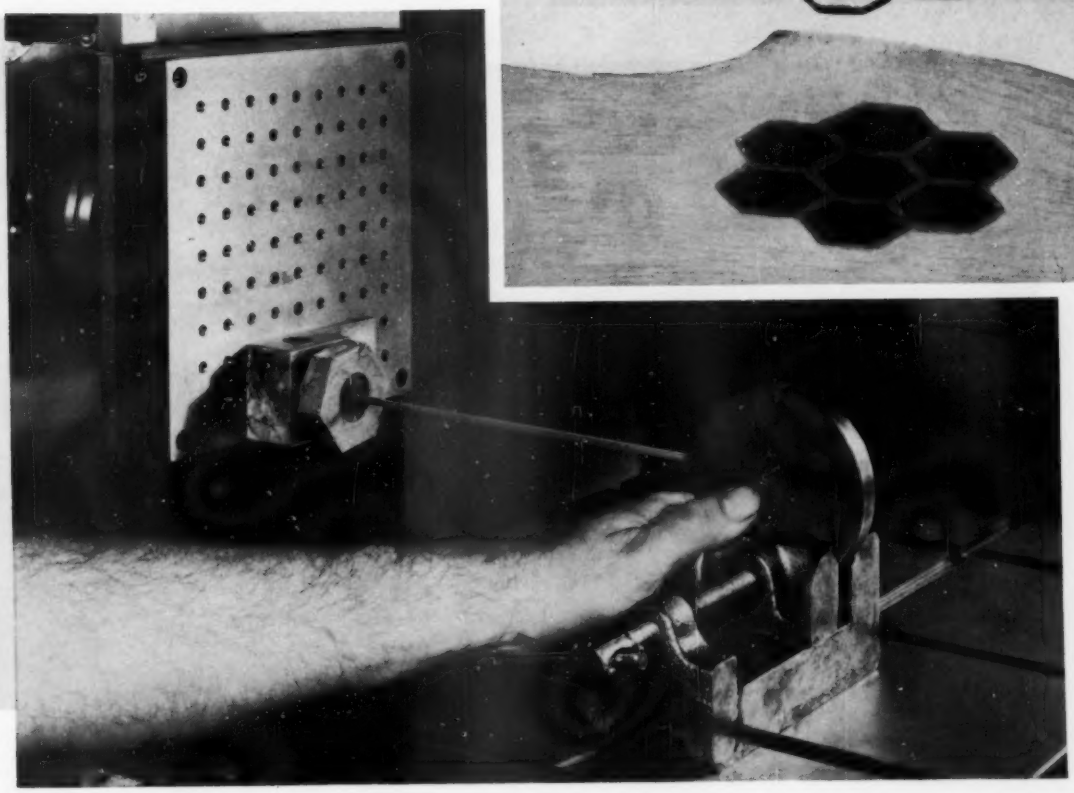
Holes and cavities of virtually any shape can be machined in the superalloys and tungsten carbides with the electrolytic machine illustrated. The machine, which was developed and built by Anocut Engineering Co., Chicago, Ill., utilizes the principle of "reverse plating" in which metal is removed from a small area rather than added to the surface of a large area. As described in Lynn A. Williams' article in this issue of THE TOOL ENGINEER, during electrolytic machining of cavities, electrolyte fluid is pumped through passages in the tool under high pressure. This insures an adequate supply of fluid at the bottom of the hole. There is no wear on the electrodes during the machining operation, since there is no physical contact between tool and work in the area being machined.

MACHINE for electrolytic drilling and cavity work. Controls are on console in foreground. Tank for storage of electrolyte is in machine base, as is pump that sends coolant through tool at a pressure of 150 psi or more. Power unit is in a separate cabinet, not shown. Power units of various capacities are available.



MULTIPLE TOOL for machining hexagonal holes. Any shape of hole can be produced with an electrode of suitable shape. Depth of hole is limited to about 12 inches with present equipment; deeper holes could be produced with a larger machine. Speed depends on amperage.

TOOL SET UP in machine for drilling hole through a hard material. Drive head at left advances tool into work at a preset rate.

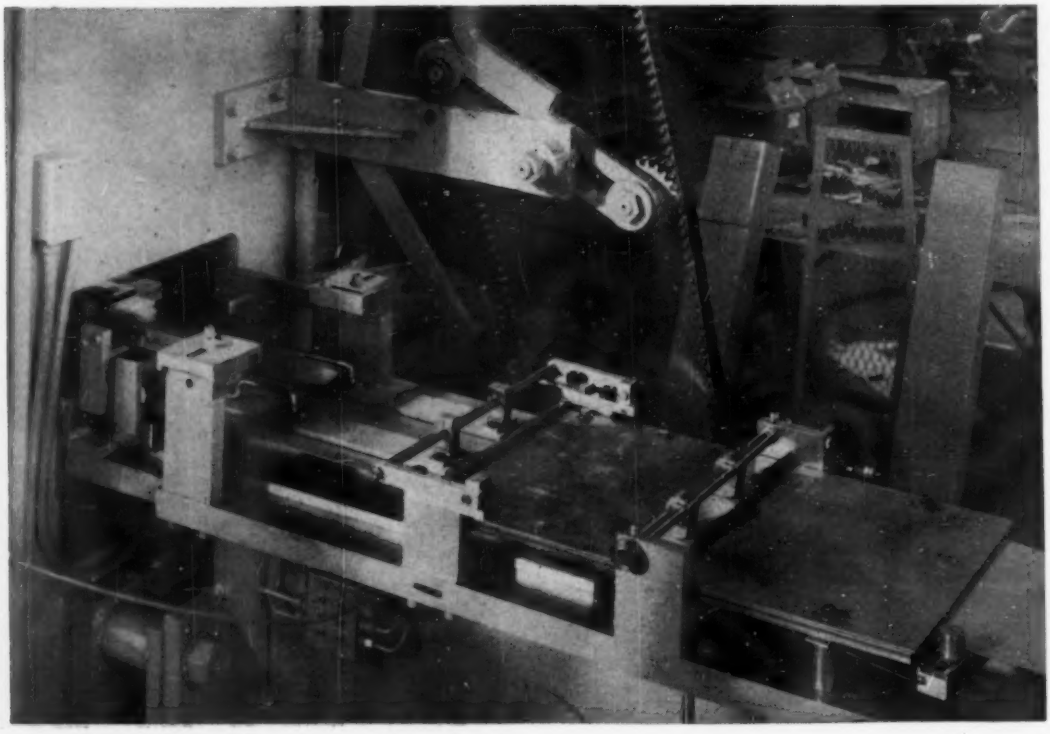


# DESIGNED FOR PRODUCTON

## Press Feed Achieves High Accuracy

Hitch feeding of coil stock at 2500 ipm is performed on this press at indexing accuracies within 0.002 inch. Developed by Precision Welder and Flexopress Corp., the unit is capable of feeding either long or short increments to the press at these speeds. The mechanism, shown in the close-up, is driven from a take-off unit through silent chain. Designed for flexibilty, the feeder does not interfere with die setting and conventional tools for forming and drawing at high speeds can be used without modification.

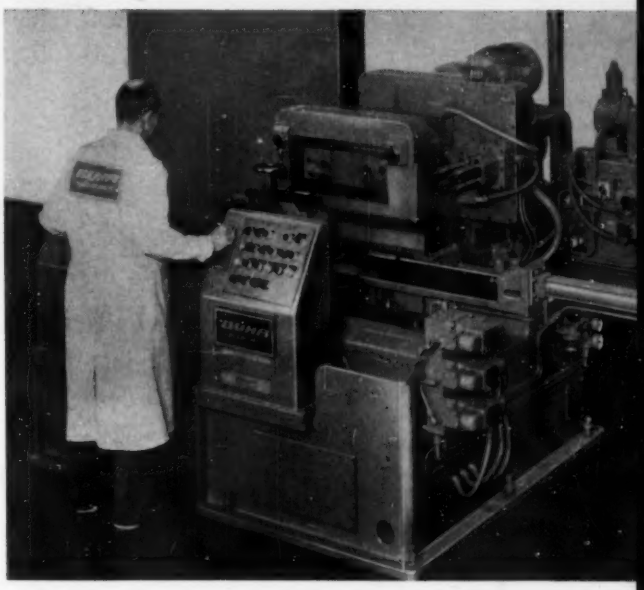
The setup shown has been running 12-inch-wide grain-oriented lamination stock at 2500 ipm with 15-inch feed strokes. At 165 strokes per minute the press pierces, blanks and cuts off the parts within 0.002 inch accuracy.



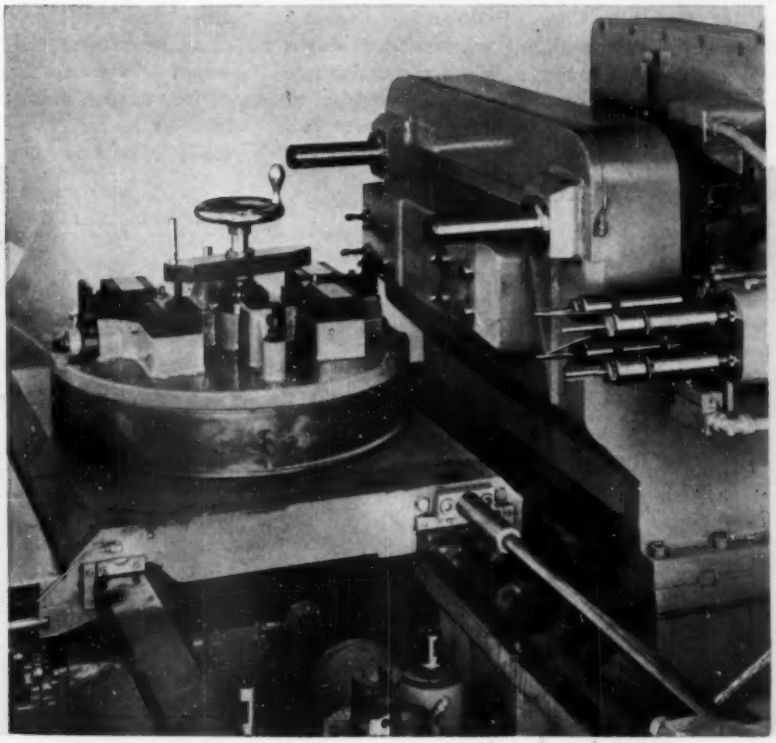
# Shuttle Machine Drills and Taps Automatically

Drilling, chamfering and tapping of four holes on each side of a flywheel housing are accomplished with an automatic machine developed by Buhr Machine Tool Co., Ann Arbor, Mich. One hydraulic feed unit and three stations are utilized to perform six operations. To accomplish this, the workpiece is mounted on an indexing table which is shuttled through the machine. After holes on one side are finished, the table indexes 180 deg, returns to the first station and repeats the cycle.

Tool movements are activated by table position and are automatically controlled to meet the requirements of the operating station. Standard units are used in combination to make the machine adaptable to design changes and the processing of entirely different parts.



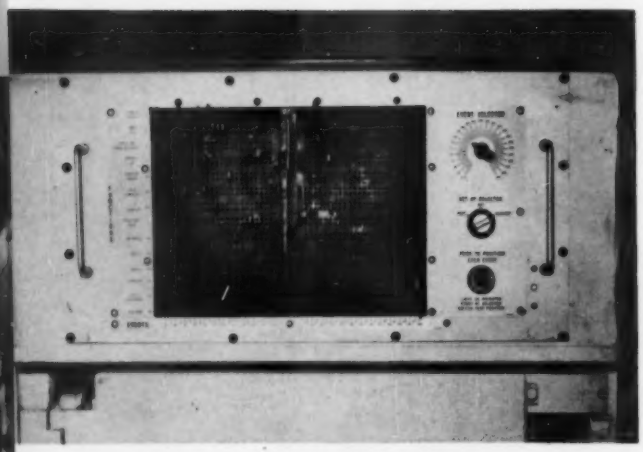
SHUTTLE MACHINE for automatic drilling, chamfering and tapping flywheel housings. Modular construction permits machine adaptation to other parts.



ROTATION of index table shuttle machine to complete operations on both sides of a housing. Workpieces are loaded and drilled in first station, then successively positioned in the drilling and tapping station. The table is indexed and returned to first station, then the machining cycle is repeated for holes on reverse side.

# DESIGNED FOR PRODUCTION

## "Pegboard" Machine Control



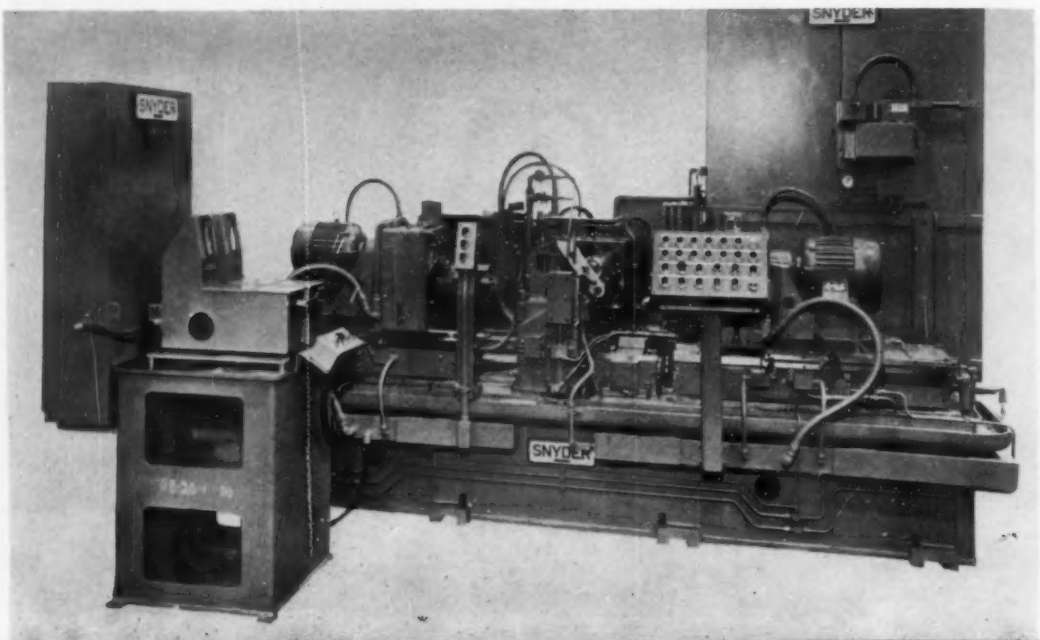
All functions or movements of the Cincinnati 200 series milling machine are controlled by a Telematic cycle control which looks like a simple pegboard. For each machine function there is a row of 24 holes, allowing the operator to "peg in" complex milling cycles of up to 24 steps.

Setup consists of inserting plugs in holes opposite the desired function in proper sequence. Trip dogs, positioned on the machine table and spindle carrier, initiate each action.

The machine functions that can be programmed are table right or left, table or carrier rapid, spindle carrier up or down, constant feed for accurate stop, dwell, quill advance, tracer control, spindle rotation, fixture control and reset. The control panel illustrated is a special 48-event model.

## Milling Machine Holds Weight Tolerance

Control of weight is as important as dimensional tolerance in the manufacture of automotive connecting rods. To maintain weight tolerance of ± 1/16 oz, Snyder Corp. of Detroit has developed a three-way balance-milling machine that weighs and machines connecting rods at a production rate of 313 parts per hour. The machine consists of three units mounted on a three-way base. Two units oppose each other, each carrying a single-spindle hollow mill head driven by a 3-hp motor. The third unit carries a drill spindle and is mounted at right angles to the axis of the opposed units. Two scales mounted at the side of the machine weigh each end of the workpiece and feed values to a memory system which dictates depth of feed to each unit. During machining, stops retract by means of hydraulic cylinders until electronic balance is established.



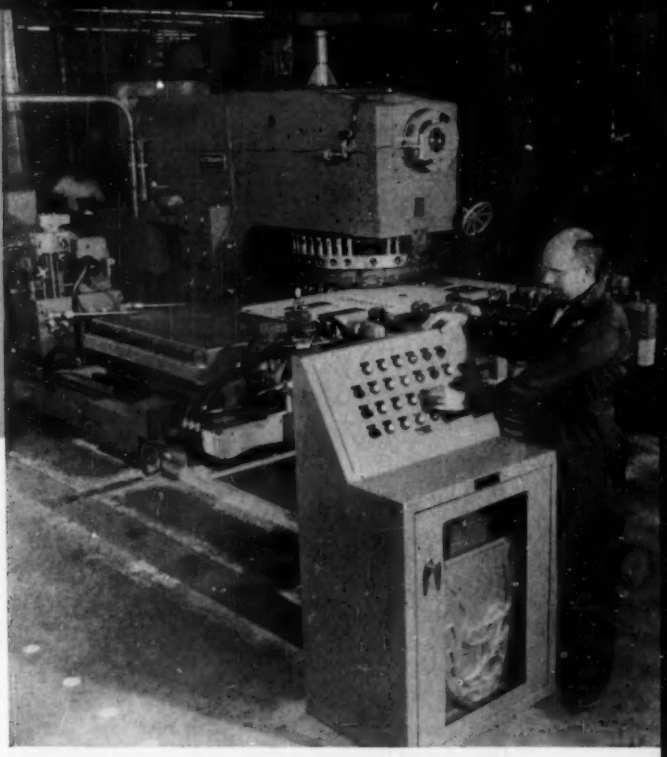


Fig. 1. Operator at console of numerically controlled press. Once the workpiece is loaded in the press and the start button is tripped, all positioning of the material is automatic.

# PIERCING AUTOMATION for short-run production

By T. W. Black
Senior Associate Editor

**Turret punch presses provide a proved means of lowering piercing costs in short-run production. With the addition of numerical control, productivity is increased five-fold and more consistent results are obtained than is possible with manual operation. Programming of the machine is also automated.**

FULL AUTOMATION—once restricted to mass-production operations—has, during the past three years, been extended to plants where production runs are short. Since the majority of the plants in this country are primarily engaged in short-run production, this new revolution in manufacturing probably has greater over-all significance than the continued evolution of "Detroit automation," whose benefits are realized only by those companies that have production runs measured in millions of units.

Most of the impressive gains in short-run production efficiency have resulted from the application of numerical control. Numerically controlled contour milling machines and numerically controlled jig borers, turret drills and the like have become standard tools for industry. With the advent of numerically controlled turret type punch presses, *Fig.* 1, automation has been extended to the short-run production of pierced parts.

Short-run production in piercing operations can be defined as production where quantities are so small that it is not economical to design and build multiple dies that are capable of piercing all of the holes in a workpiece with one press hit. One solution to the problem is, of course, to pierce each hole individually, using a standard punch press. When holes in a sheet are of several different sizes and shapes, however, the time required for die changes is excessive and, unless elaborate gaging systems are devised, accuracy of hole location becomes a matter of chance.

The tool change problem and the positioning problem are both solved by the use of turret punch

**Fig. 2. Numerically controlled Wiedemann turret punch press. This press, which has a capacity of 100 tons and 63-inch throat depth, can automatically pierce up to 30 holes per minute in metal sheets up to 60 x 100 inches, ⅜ inch thick.**

presses, *Fig.* 2. Punches and dies for various hole sizes and shapes are carried in a revolving turret. One edge of the sheet is clamped to a cross slide that travels on a cross bar or way. Movement in a second axis is obtained by mounting the cross bar itself on ways or slides so that it can be moved in a direction perpendicular to the cross slide travel. With this system the sheet can be moved in two axes so that it is in proper position for punching of each successive hole.

Depending on speed and accuracy requirements, any of several means of locating the sheet for punching each hole can be selected. Perhaps the most common method for small work, such as printed circuit boards, is the use of a precision metal template and stylus arrangement. Essentially, this is a pantograph system. The operator locates the stylus at the appropriate point on the template and the machine table is automatically positioned accordingly. The operator also controls the rotation of the turret so that the correct tool is used for each hole size and shape. A typical setup is described in THE TOOL ENGINEER, Oct. 1956, p. 113.

Templates are not often used in the piercing of large sheets. Usually the operator, working from a special drawing or tabular data on an operations sheet, positions the sheet by means of handwheels. The *X* and *Y* coordinates for each hole are "dialed" by the operator.

While the productivity of manually controlled turret punch presses is much higher than that with conventional punch press equipped with a single punch and die, there are definite limits to efficiency. Each hole is pierced in a fraction of a second and most production time is taken up with positioning the sheet for successive piercing operations. Productivity, then, depends almost entirely on the press operator since he controls the duration of the positioning and repositioning time. When piercing large sheets, even a highly skilled operator cannot exceed five or six press hits per minute over the course of a working day. Further, there is always the possibility of operator error when positioning the sheet, or of punching the wrong size hole. A certain amount of scrap is inevitable.

Installation of a numerically controlled turret punch press at the General Electric Specialty Control Dept., Waynesboro, Va., solved these problems. Once a sheet is positioned in the workholding fingers of the press, *Fig.* 3, all positioning of the sheet, selection of punches and dies from the turret and the actual press stroke are automatic. Operator instruction sheets and special drawings have been replaced by lengths of punched tape, each of which contains a complete piercing program for each job.

Production results with this equipment, which is used in the production of panels for large control cabinets, have been outstanding. In place of the five or six hits per minute possible with operator control, 30 or more hits per minute can be obtained. This figure is based on four inches average table motion in both axes for each hit, 30 degrees average turret motion and approximately three turret changes per minute.

**Machine Design:** The turret punch press, designed and built by the Wiedemann Machine Co., has a capacity of 100 tons and a throat depth of 63 inches. It can pierce sheet metal or plate up to 60 x 100 x ⅜ inches. It was specifically designed for high-speed automatic operation. Table speed is 600 inches per minute and the turret, which holds 36 sets of punches and dies, rotates at a speed of 15 revolutions per minute. Table motions are powered by double rod end hydraulic

cylinders. High response, linear proportional servo valves are used for cylinder control.

A piston type hydraulic motor, operating through a gear reducer, powers the turret. The punch and die turrets are 55 inches in diameter with a combined weight of 6500 pounds when fully tooled. This heavy mass is accelerated to a rotational speed of 15 revolutions per minute, decelerated and stopped with an accuracy of $\pm 1/16$ inch with respect to the center line of the turret locking or index pins. Final position and accurate alignment of the punch and die turrets is obtained by inserting these pins into bushings in the turret automatically. During this operation an air-operated disk type clutch, located in the drive backshaft, is disengaged, isolating and removing the effect of gear reducer and hydraulic motor inertia from the system. The clutch also serves as a safety device by slipping under excessive overloads.

Automatic workholders, sensitive to signals generated by proximity pickups, permit punching close to the edge of the sheet. When the pickup head registers with a profile cam located in front of the turrets, the workholder jaws open and the clamp is retracted. When the head moves away from the cam, the workholder returns and reclamps the sheet. These units eliminate the necessity of interrupting the machine cycle for manual relocation of the clamps when edge-of-sheet punching is required, thus result in faster operation.

**Control System:** The press is equipped with a modified General Electric Mark III control. All operator controls and the tape reader are enclosed in a control console located at one side of the press. Control accuracy for positioning of the sheet is $\pm 0.005$ inch and rotary accuracy of control for the turret is $\pm 1/4$ degree. The tape is a standard one-inch-wide punched tape. During machine operation, the tape advances to read the next positioning cycle; instructions for operations are retained in a memory unit as the tape is advanced. This means that there are no machine cycle delays caused by tape reading.

The system is self-correcting and self-checking. Table motions are maintained under continuous servo loop control at all times except for a brief interval after the punch has been stripped from the work. The loop is opened at this time to permit the transfer of data from buffer storage to the servo amplifier sections. During closed-loop control, continuous position feedback signals are generated by selsyn transducers connected to the moving table components by rack-and-pinion drives. These racks are accurate within 0.002-inch accumulated pitch error in 100 inches of rack length. The feedback signals are compared to input signals and the press will not cycle until the two sets of signals match. These insure accuracy.

**Tape Preparation:** Tape preparation is accomplished either with a standard tape punching machine, working from a simple chart listing the *X* and *Y* dimensions and the turret station number for each opening, or with an automatic programmer developed by General Electric. This programmer produces a manufacturing control tape from dimensionless line drawings.

A typical job for the automatic programmer begins with a rough layout prepared by an engineering assistant using drafting templates that show the hole size and shape. After templates have been positioned approximately on an outline drawing of the panel, a draftsman accurately positions the

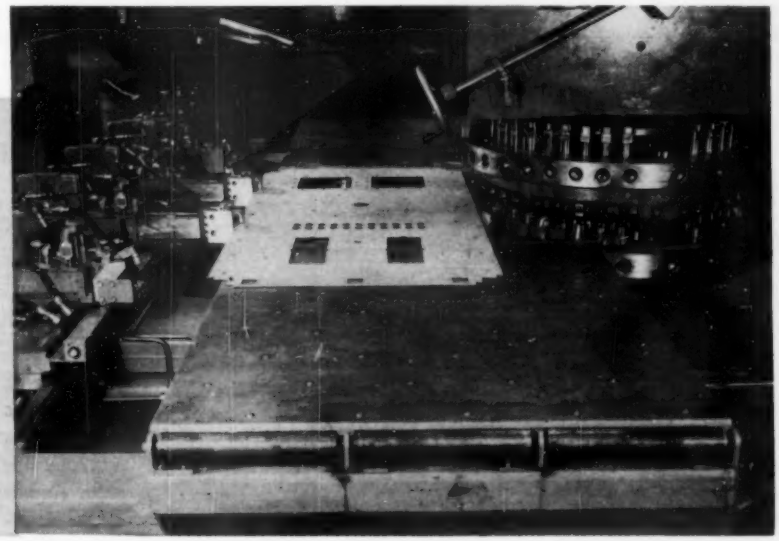


**Fig. 3. Workholders grasp edge of sheet, which is moved in and out and left and right as required for the punching of each hole. Revolving turret holds 36 punches and dies.**

**Fig. 4. Automatic programming machine. Half-scale dimensionless drawings are used to produce control tapes for the turret punch press.**

templates using a scale and secures the entire layout to the programmer.

The draftsman operates switches on the machine's control console to select the rotary turret punch positions required to produce the panel. He then centers a locating device over center line markings on the template for each punch. When centering is completed, the operator trips a foot switch. A bright "pin point" dot, projected optically onto the templates, facilitates centering. The *X* and *Y* dimensions, as measured by the locating device, are transferred from the layout to information storage and read-outs in the programming machine. A second foot switch causes the information to be punched on tape. At the same time, the center line location just programmed is automatically marked on the layout by a felt pen to eliminate the possibility of repeating holes accidentally.

A Diazo transparency is then made of the layout. After part numbers and a drawing number have been added to the transparency, it becomes an assembly drawing for use in the factory.

The control is checked by running it through a special automatic typewriter that produces a typed specification sheet. A duplicate tape is automatically produced at this time. This duplicate tape is sent to the factory for use with the turret press. The original or master tape is filed and can be used to produce additional duplicates in the event of damage to the tape used for production.

**Cost Savings:** General Electric engineers estimate that the numerically controlled machine will save $48,000 during its first year of production. Direct labor savings, owing to the greater productivity with numerical control, will be $19,000, with an additional savings of $6000 in indirect labor. Reduction of scrap losses will save $5000. Elimination of special tools—multiple-hole punches—will save $4000. The new machine uses only standard tools. Because of the speed of the machine, there will be no need for subcontracting during periods of peak loads. This will save $20,000. Drafting time savings will be $3000—a saving which is more significant than the dollar amount would indicate, since it will be possible to use engineering time for more creative work. Savings in overhead will be about $1000 yearly. These savings add up to $58,000 per year. Subtracting $10,000 for depreciation, the actual cost reduction is $48,000. Inventory reduction could be $20,000.

Savings of this magnitude may not be possible in every plant. They do, however, indicate that the possibilities of using numerical control should be seriously studied in all plants where increased flexibility and speed in piercing operations are desired.

## Flame Ceramics Lengthens Component Life

FLAME CERAMICS, a process developed by Armour Research Foundation, has found important applications in the diesel, jet and ramjet engine fields, and in the making of steel. The process is a method of applying an adherent refractory coating onto a surface. Solid crystalline particles are injected into a gaseous stream being fed into a continuous flame generating device. The particles are heated to sintering temperature in the flame and are impinged on the surface being coated to form a crystalline deposit. The particles are of an oxygen-containing material that is refractory at 1200 c.

The process is of particular utility in coating metal surfaces to protect them against oxidation and other high-temperature effects but is also applicable to the coating of glass, carbon, concrete and various other materials.

An important current application is coating the combustion chamber of a ramjet engine. Another successful application is coating the piston crowns, valves and cylinder heads of diesel locomotives. Coating of furnace rollers to reduce wear is another highly successful application. Patent rights are held by Continental Coatings Corp., Cleveland, Ohio.

# Heat Treating for longer tool life

By Julius Turk*
Metallurgist
Paulo Products Co.
St. Louis, Mo.

**Proper heat treating of tools and dies to obtain desired physical characteristics and maintain size, presents a real challenge to tool engineers. Special techniques and controls were required to process the complex tools described by the author in this article.**

HEAT-TREATING PROBLEMS are many and varied. Tool and die designers, for example, can select materials from any of six major groups of tool steels and from a large number of structural steels. Each of these steels may require somewhat different processing than any of the others. Further, the design of the tool itself, its intended use, process handling conditions and dimensional stability requirements all affect the selection of heat-treating methods.

In the past, heat treating was a much more hit-or-miss process than it is today. Cooperation between tool designers, steel makers and heat treaters has resulted in substantially improved reliability of heat-treating operations. New approaches to heat treating and new types of equipment have also resulted in significant improvement.

At the same time, there are many products that tax the ingenuity of even the most skillful heat treater. Complex high-strength aircraft parts, *Fig.* 1. die casting dies and molds for plastics parts require special processing techniques.

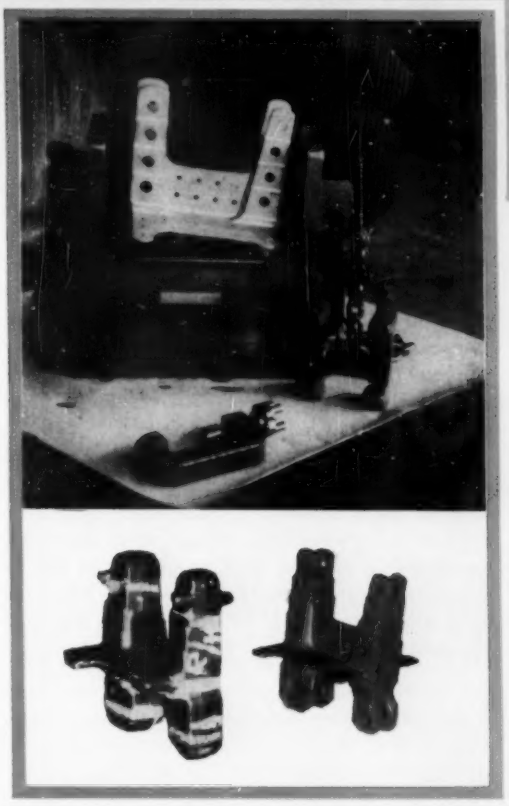


**Fig. 1. Tempering fixture for an aircraft hinge fitting. After positioning center spacer bar, supplementary clamping attachments hold part in proper dimensional location. (insert) Forged and finish machined fitting. As-forged weight is about 100 lb while finished part weighs less than 40 lb.**

**Plastic Cup Mold:** An example of a difficult-to-heat-treat product is a mold used to produce a total of five million plastic cups at the rate of 200,000 cups per month. These molds were designed for minimum maintenance and long service life.

**Abstracted from Paper No. 237, "Special Heat Treat Techniques—Some Case Studies," presented at the 27th ASTE Semiannual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.**

***Senior member ASTE St. Louis chapter.**

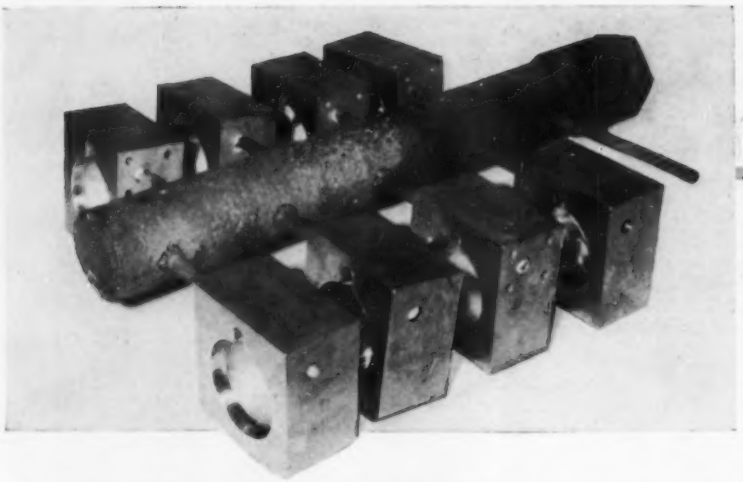


**Fig. 2. Manifold fixture and feeder tubes with molds attached. Feeder tubes are inserted completely through core pin holes as shown in lower front mold. The extra tube holds test sample for analysis.**

To conserve the expensive plastic raw material, the tool steel had to have uniform properties, with no size change during or after heat treatment. A variance of only a few thousandths of an inch between different molds would result in units being produced with heavier wall sections. Consequently, more material would be used to produce the same number of units. While the increase per unit weight would be small, the over-all weight for a great number of units would be substantial.

These special properties required the selection of a general purpose, air-hardening tool steel. This material has a satisfactory combination of properties such as hardenability, strength, shock-resistance, machinability and hot work properties, as well as minimum distortion in heat treatment. Since the mold was to operate at 3000 psi on the inside of the cavity, it was desired to maintain zero movement of the cavity at the approximate molding temperature of 330 F.

Previous experience with this type mold emphasized the importance of establishing—and compensating for—growth and movement. In some instances growth had been detected at operating temperatures although the heat-treat tempering temperature was above the operating surface heat of the cavity face. This condition could be attributable to the effect of untransformed microstructures induced by the heat treatment of retained austenite, which later transforms to a structure of greater volume. To eliminate or minimize such effects by obtaining more complete structural transformation, a deep freeze operation was introduced between tempers. For even better dimensional stability, a subcritical anneal or stress relief operation after rough machining was found desirable. The critical

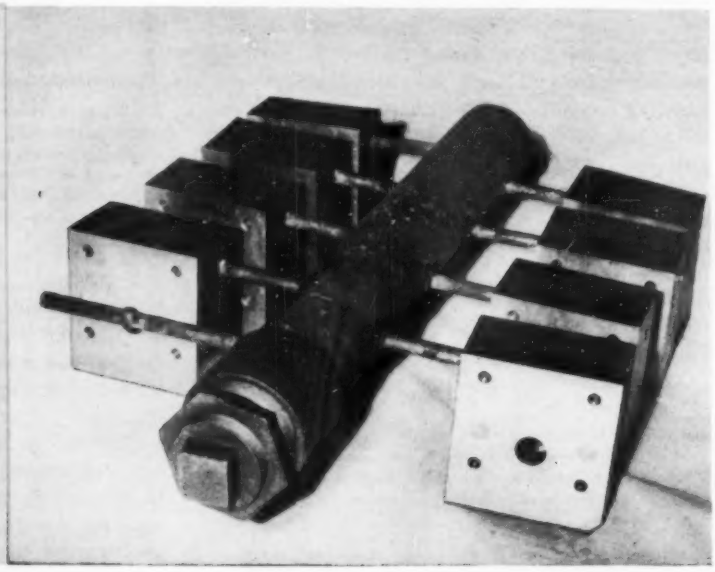


**Fig. 3. Back-end view of manifold fixture with a fitted plug. Carburizing compound is packed through this end and sealed by the pipe plug.**

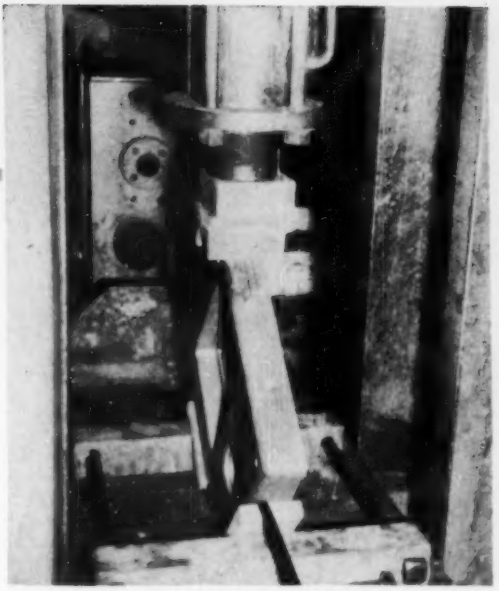


**Fig. 4. Aluminum die cast die being straightened by application of a vertical load in a hydraulic press. Special locating blocks were made for the press ram and the supporting blocks on the bed of the press.**

nature of the stability requirements made it mandatory that the annealed stock be as consistent as possible in this condition. It was also noted that galling between the core pin and core pin hole was not uncommon. Apparently, the variable section size and mass involved induced slightly low hardenability in the core pin holes.

These experiences were taken into account in the heat treatment of the molds. Wear resistance of all faces was improved, especially in the core pin holes. To accomplish this, a manifold fixture, *Fig.* 2, with perforated feeder tubes was constructed with one end sealed and the other end assembled with a pipe fitting. The unit is packed with a carburizing compound and sealed, as shown in *Fig.* 3. Each feeder tube is inserted through the core pin hole of the mold. During heating for the hardening cycle, carbonaceous gases permeate the inner areas of the holes, resulting in a carburizing effect at these surfaces and greater surface hardenability. During the process, a slight carburizing atmosphere is employed. The dew point is maintained to prevent an excessively high-carbon potential—a condition favorable to "soft skins" caused by retained austenite.

Because of the different masses of the molds, a 30-second oil quench is used instead of straight air cooling. This enables the heavier sections to be critically cooled for maximum hardenability without any noticeable additional distortion. Also to obtain full advantages of continued critical cooling, a blast of air is directed through each core pin hole after the interrupted oil quench. During the cooling down cycle, each mold is turned to maintain flatness.

The special handling in the processing of this plastic mold results in attainment of the desired wear properties. Dimensional stability is held to a total out-of-roundness of about 0.002 inch.

**Aluminum Die Casting Die:** An aluminum die casting die positioned in a 50-ton straightening press is shown in *Fig.* 4. Made from a 5 percent chrome air-hardening steel that was pack hardened and tempered to 46-48 $R_C$, the die exhibited an unusual material movement after heat treatment. This problem was primarily one of attaining dimensional stability. Over-all dimension of the die was 11 x 13 x 2 inches. Weight was 60 lb. The die was stress relieved after rough machining and the cavity was then finished machined and ground. Therefore, the cavity should have been held to as close to a zero movement as possible.

After heat treatment, the cavity was found to have maintained edge and side parallelism but two sides indicated an out-of-square condition of about 0.010 inch. There appeared to be a condition of parallel slip of two sides. This type of movement is different from the growth, shrinkage or bowing effects usually encountered. In order to correct this movement as much as possible, a direct vertical load was first applied after positioning and clamping the die (which was heated to approximately 700 F) in an offset horizontal position in a 10-ton press. When no movement at this loading was noted, the die was heated to 900 F and positioned, as shown in *Fig.* 4. By a vertical load application to the angular position of the die, it was considered that any shifting would be consistent in direction of the two out-of-square sides. The movements would equalize one side against the other. A load of 90,000 lb indicated some such movement, but the die recovered after cooling. The die was then heated to the original draw temperature, 1100 F, and a load of 100,000 lb applied. By shifting the out-of-square sides approximately 0.010 inch past center, the die recovered approximately 0.006 inch on cooling. The condition was considered satisfactory for salvage.

These examples illustrate techniques introduced to achieve a specified set of conditions or properties for either an improvement of wear characteristics, or a critical dimensional problem or both. The choice of correct tool material and proper design based on intended application will minimize or even possibly eliminate many problems induced by the heat-treating cycle.

Air-conditioned facilities are devoted exclusively to performing finishing operations on high-precision angular contact bearings made at Norma-Hoffman Bearings Corp. Specially devised manufacturing techniques and continuous in-process inspection are employed to insure standards of quality.

PREVIOUSLY GROUND FACES of inner and outer rings are precision lapped simultaneously. The lapping machine has automatic turntable loading, ejection and demagnetization. Ring faces are critical locating surfaces for subsequent grinding operations.

INSIDE DIAMETERS of races are ground on a shoe type centerless internal grinder with inclined table. Fluid pressure clamping device holds work against rotating backing plate providing a nonslip drive without distorting the race.

# TOOLS at work

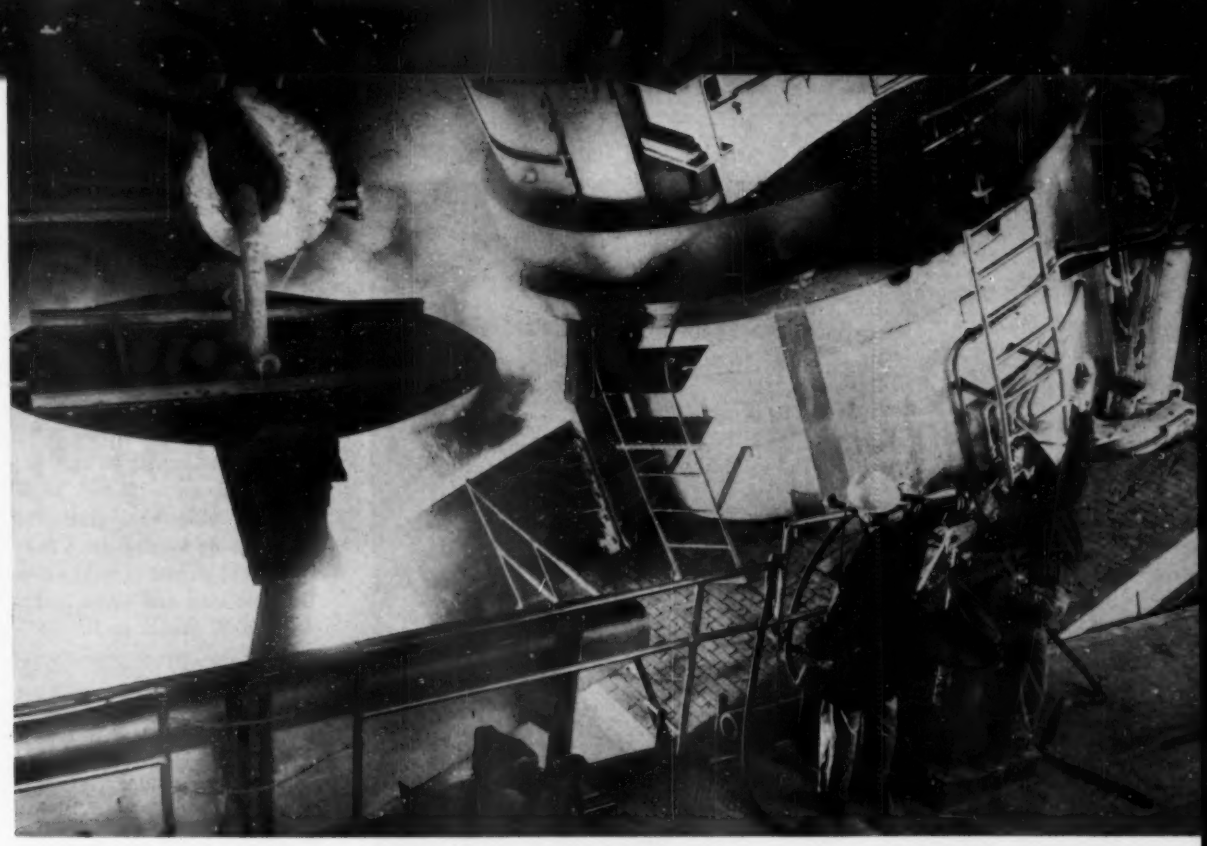
OPERATER of ball track grinder checks rings on gages that feed an electronic amplifier. Measurement dial is read in steps of 0.0000025 inch.

HONING machines developed by Norma-Hoffman engineers produce precision surface finish on ball tracks. Fine finish reduces noise and contributes to lower starting and running torque.

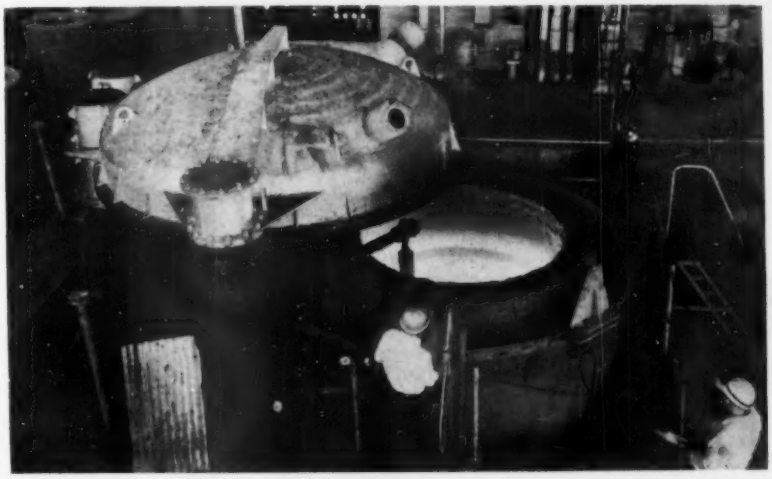
ROTARY SURFACE GRINDERS perform final preload grinding of inner and outer races. Machines are equipped with in-cycle air gaging. Measurements are displayed on a large dial indicator. The gage is interlocked with feed mechanism to prevent accidental overgrinding.

## TOOLS at work

IN FINAL assembly operation, outer race is momentarily heated on high-frequency induction unit to allow inner race, balls and retainer ring to drop into place.

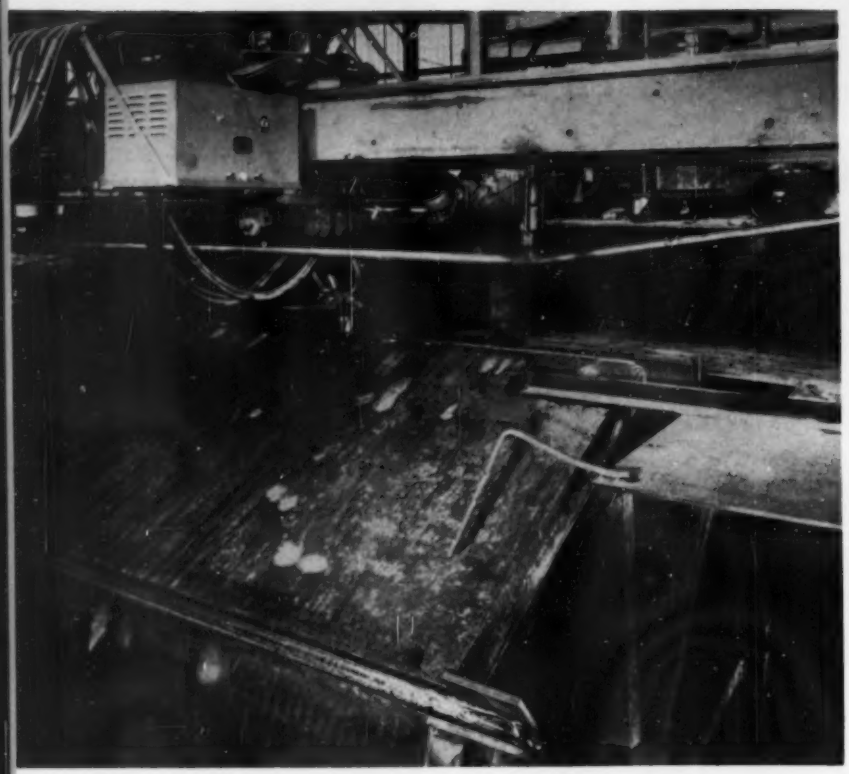


VACUUM DEGASSING PROCESS for die steels begins at A. Finkl & Sons Co. with tapping of electric furnace. The 75,000-pound heat of alloy steel is discharged into ladle in pit. Degassing removes impurities.



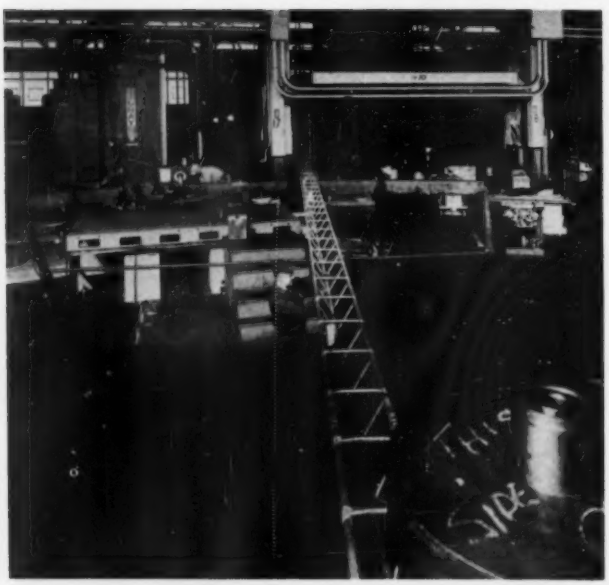
ALLOY STEEL is degassed in approximately 12 minutes in ladle at about 3000 F. Four steam jet ejector suction pumps provide vacuum. Degassing action is aided by injection of helium gas into the molten steel.

VACUUM degassed steel is poured into ingot molds from ladle after removal from degassing chamber. Temperature at this point is about 2850 F.



SEAMS of polar axis shaft of 140-ft radio telescope are welded on special setup at E. W. Bliss Co. Two automatic welding heads are mounted on radial drill presses, which in turn are suspended on a boxed beam with a machined rail plate. The two welding heads form a common weld puddle to weld seams five feet long and seven inches deep in 79 passes each.

## TOOLS at work



PITCH radius line is scribed on segment for polar axis gear with a scriber mounted on the end of a 42½-ft television mast within a tolerance of plus or minus 0.002 in. The segments average about 30 ft in length on the pitch radius. Polar axis will be 85 ft in diameter when assembly is completed.

# increasing die life

**By Otto and Werner Kienzle**
**Hannover Technical Institute**
**Hannover, Germany**

**Punch and die life is shortened, rather than lengthened, by polishing punch and die faces. Paper glued to the face of the sheet increases tool life. These conclusions are based on extensive laboratory tests made by the authors.**

OBTAINING MAXIMUM TOOL LIFE depends on many variables. These include thickness and physical properties of work material, punch and die alignment and material, press vibration and speed, and die clearance. Although some of these factors are difficult or impossible to control, an understanding of their effect on the shear process enables tool engineers to substantially lengthen the interval between punch and die sharpenings.

An analysis of shear operations much include answers to three fundamental questions: (1) What happens at the cutting edge? (2) How do burrs originate? (3) How does wear originate? In *Fig.* 1, two cutting edges separated by dimension *u*, die clearance, act upon the sheet. A mechanical consequence of die clearance is bending pressure which, in the case of thin sheets, lifts the center part away from the punch and the outer part away from the die.

This action results in plastic flow of metal in the workpiece. As depth of punch penetration increases, plastic deformation in the area of perforation also increases. Its radial extent increases with die clearance and ductility of the workpiece. Stripper action is omitted in *Fig.* 1, as an inconsequential factor affecting plastic flow. Further deformation occurs in the cutting zone, *Fig.* 2, until fracture.

**From an article published in *Stahl und Eisen*, Vol. 78, No. 12, June 12, 1958, translated by Armco Steel Corp. and issued by the ASTE Metal Stamping Research Fund Project.**

When metal is perforated by a newly sharpened die, the greatest tensile stresses occur on the die side of the sheet because of the stretching of the outside fibers. Only material from the slug is available for stretching in a radial direction but, on the upper side, material can flow in from a broader area. Additional stretching and tensile stresses result from the arching of the slug. A necessary conclusion is that fracture does not commence on the upper (punch) side of the metal, as is generally assumed, but on the lower (die) side. This conclusion is substantiated by *Fig.* 2.

It can also be concluded that materials showing excellent drawing characteristics have poor perforating ability due to plastic flow. Conversely, metal showing good punchability is generally unsatisfactory for draw operations of any depth.

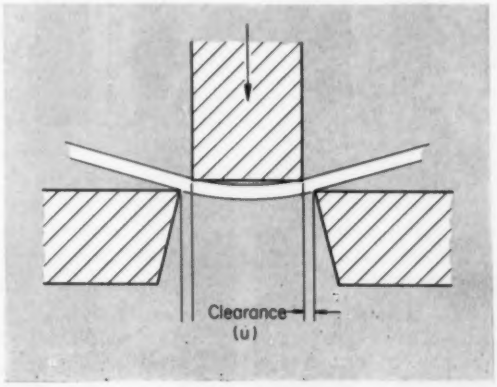



**Fig. 1. Slippage and plastic deformation exaggerated here, are important factors affecting tool life.**

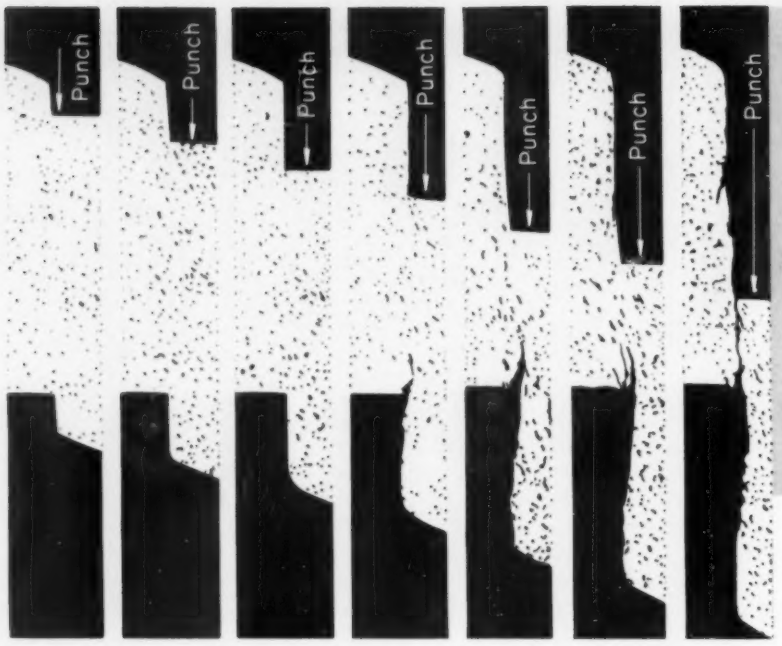



**Fig. 2. Stages of cutting process when cutting 0.049 inch thick sheets of electrical steel. It is apparent that fracture occurs at the bottom of the sheet.**

The process of fracture is altered when the punch and die are worn, *Fig.* 3. As a result of rounded cutting edges, the outside fibers are under less tensile stress. Work hardening is therefore increased. Fracture commences simultaneously from each side and burrs develop on both workpiece and slug.

Burr formation is not caused by a flow of metal into the rounded areas of the punch and die although its occurrence is a direct result of worn cutting edges. As edge breakdown increases, the work hardening effect increases proportionally. Since deformation in metals is greatest in areas of maximum pressure, metal does not break at the cutting edges, but at a certain distance from them. This factor, more than any other, is responsible for burrs.

Metal slippage between tool faces is an important phenomenon incidental to face wear. Factors affecting slippage include roughness and tensile strength of the work material, roughness of the tool surfaces, and effectiveness of lubrication. Slip paths on the faces are short but they are traversed under high pressure. At the cutting edge, slip is disturbed because of its directional change. Resulting increased mechanical strain is one reason that punches break more readily at the corners. Slippage, as a factor affecting wear and breakage, can be minimized by

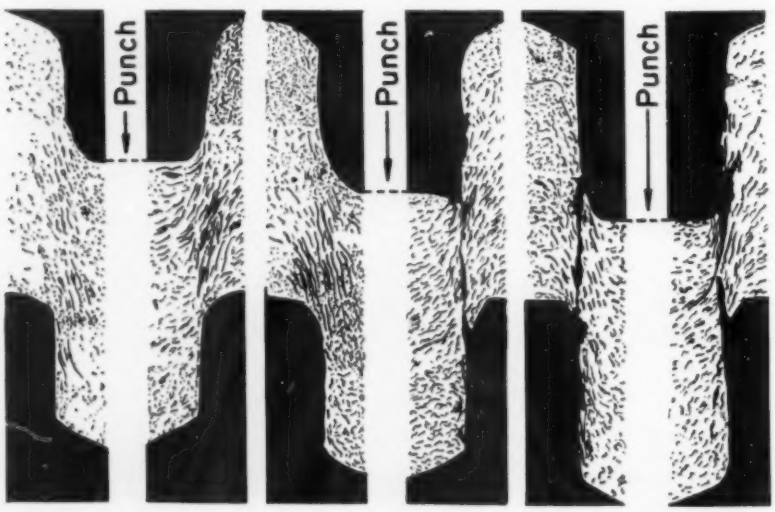



**Fig. 3. Stresses are more evenly distributed when tool edges are worn.**

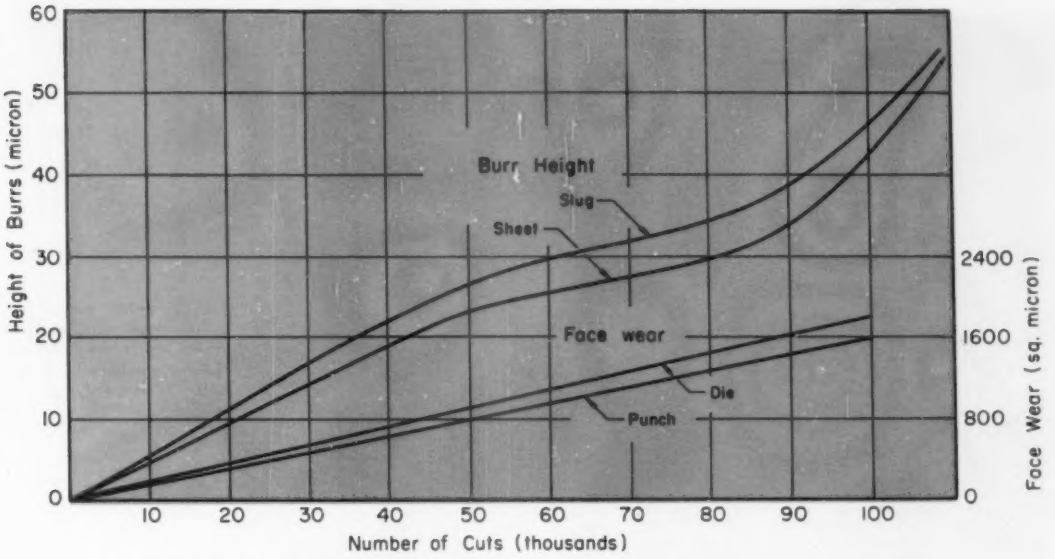



**Fig. 4. Relationship between burr height and face wear. One micron = 39.4 microinches.**

increasing surface roughness. For this reason, the well-established practice of lapping and polishing both punch and die faces is superfluous and detrimental to tool life.

An intermediate layer of paper minimizes slippage and has a beneficial effect in extending tool life. This has been proved in the shearing of electrical sheet steel (silicon steel) that has paper glued to one side. The tool face that contacts the paper has appreciably longer life.

Side wear is caused by frictional force between the punch and workpiece during perforating operations. Friction is caused by ring tensions which build up from metal deformation. Its force is apparent when stripping pressures are evaluated. Pressure-fitting investigations show that the adhesive coefficient (frictional force) decreases with increased impression speed. From this it can be concluded that as cutting speed increases, side wear decreases. Corresponding improvements are shown in wear of longitudinal edges as impression speed increases. Longitudinal edges rise vertically from sharp corners in the cutting edge.

Cutting resistance and stripping force increase with increased tool wear, but further investigations are necessary to determine the relationship between cutting force and wear. Definite need exists for such investigations for it would be convenient to indicate wear limit by increased cutting force.

Questions are often asked about the influence of the hardness of the tool on face wear. For this, experiments were carried out with a low-alloy tool steel. Tools were hardened under identical conditions and then tempered to 59-61 HRC. It was shown that the face wear in this area depends definitely upon the hardness of the tool material and, with increasing hardness, decreases by about 20 percent. This observation suggests that further experiments with even harder tools should be carried out.

A further question that is often asked relates to impact speed. As a result of experiment, the following was shown: with an increase of the impact speed from 0.26 to 0.65 feet per second, the wear decreased by hardly eight percent. The significance of this result lies in the fact that the wear does not increase with greater speed, as one might expect from previous experience with machining operations. From the point of view of tool wear, therefore, there is no objection to increasing the number of strokes per minute.

Wear causes an increased burr on the workpiece. Since the quality requirements limit the quantity of stampings produced per tool grinding, the amount of burr is definitely a limiting factor on tool life from a practical standpoint. To test the increase of burr during the course of a run, maximum burr height was measured on five slugs and five holes after each 5000 cuts during a test run of 110,000 pieces. Curves for the punch and the slug are shown in *Fig.* 4. Up to 50,000 pieces, burr height is proportional to the number of cuts. The increase is also linear, but at a lesser rate, between 50,000 and 75,000 cuts. After that point, the curves again rise more steeply and reach the initial rate of increase. They rise again at 85,000 to 90,000 cuts; then there is a steep rise. During the course of the test run, the height of the burr on the slug was always a few microns greater than that on the punched sheet.

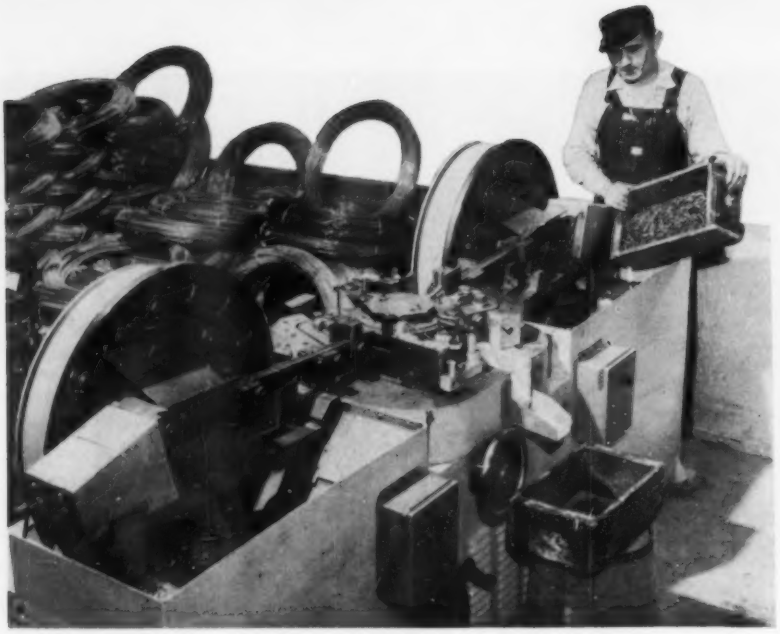


Fig. 1. Large wheels at either end of Prutton planetary screw thread rolling machine pick up nails before rolling.

# THREAD ROLLING

## *feeders improve output*

**By A. C. Ellsworth**
**Application Engineer**
**Darwin and Milner, Inc.**
**Cleveland, Ohio**

**By departing from conventional concepts of thread rolling machine design, it was possible to develop a new machine that has increased production 550 percent.**

HIGHER PRODUCTIVITY can be attained in several ways. One approach is to redesign existing equipment. A second—and often more fruitful—approach is to study the basic manufacturing problems involved and design new equipment to do the job. This second approach has been used in designing a special machine for screw nails, *Fig.* 1.

Screw nails, *Fig.* 2, are made by rolling a helical thread on a conventional nail. Because of high production requirements, these nails are rolled on automatic machines, which are conventionally fed by rotary feeders. Because of their shape, nails tend to jam together into clusters. Breaking these clusters is always a problem when conventional feeders are used. Keeping different sizes of nails sorted is also a problem. A nail of the wrong size can jam the feeding mechanism. Feeders and hoppers are usually built high above floor level in order to utilize gravity. Lifting boxes of nails to shoulder height or higher requires considerable manual effort on the part of the operator and can decrease his efficiency. All of these problems were taken into account in the design of the new machine.

**Feeding:** To lower the feed level to a more efficient height and break up the clusters of interlocked nails, two large cast-iron wheels are used to pick up the blanks. These wheels are located at either side of the screw rolling die, forming a dual feed system. Lugs at the inner side of the feed wheel rim effec-

**Fig. 2. (above) Screw nails are made by rolling a helical thread on a conventional nail.**

**Fig. 3. (upper right) The use of a spring-actuated bell crank minimizes the danger of jamming at the point of escapement.**

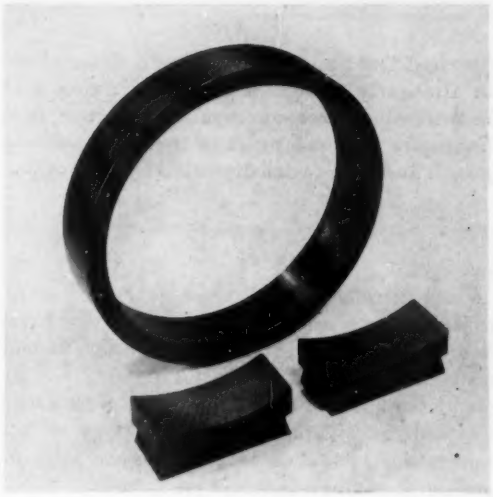


**Fig. 4. (right) Die components will thread 3 to 5 million blanks before replacement is necessary.**

tively break up the clusters and deposit the nails on a sheet metal guide leading to the inclined feed track. A vibrating unit then moves them down the track into the die loading position.

The feeding mechanism is readily accessible as a means of forestalling jam-ups. The operator can visually detect a wrong-size nail and remove it manually. Tool engineers at the Hillwood Mfg. Co. have added a further refinement to the track in order to eliminate human error. They have installed an adjustable blade which, when set to the desired length, will not permit passage of a larger nail.

A cam mounted on the die assembly, *Fig.* 3, operates the escape device that feeds the die. Lobes on this cam actuate a follower mounted at the end of a bell crank. At the opposite end of the bell crank is the feeding device which moves the nail from the track into the die.

An additional safety measure is found in the design of the bell crank. Usually designed as a single detail, this crank consists of two members connected by springs. As such, the feed is not positive, and should a longer nail reach the escape mechanism, it cannot be forced into the die.

**Die Design:** The working portions of the die, *Fig.* 4, consist of a planetary die ring and two opposed shoes. Their centers of arc are not concentric, the radius of the shoe being somewhat larger than that of the ring. There is a threefold advantage in this design as it permits easy entry for the blank, the thread is rolled gradually, and the threading operation is completed without a finish-up mark on the nail.

The die shoes and planetary rings are annealed forgings of Mineor air-hardening tool steel. In contrast to the conventional procedure of grinding the teeth into the hardened working face, these teeth are milled with a minimum of stock left for grinding.

Heat treatment requires two 4-hour drawing operations. Hardness is 58-60 $R_C$. With SAE 1035 nail stock, production runs of 20 tons of nails between die sharpenings are obtained.

# *avoiding*
# TOOL FAILURES

**By Cecil E. Chapman***

**Superintendent**
**Inland Steel Co.**
**East Chicago, Ind.**

**Service life of punches and dies is determined in the early design stages. Machining and heat-treating procedures also influence life. Examples of good practice that lead to long punch and die life are discussed by the author.**

TOOL FAILURE in punch press operations can be caused by poor design, stress raisers in the tools, faulty heat treatment or improper selection of tool materials or lubricant. The best way to head off the main causes of tool failure is to study these variables and their relationships in each phase of tool construction. Attention to good practice helps to prevent premature punch and die failures.

**Material Selection:** Selecting the right material for the job eliminates or reduces fabrication and heat-treating problems and results in satsifactory service life. The designer should keep in mind that ultimate tool cost is strongly affected by these factors. A material with low initial cost may not be the most economical in the long run if it is difficult to machine, requires special heat-treating techniques or breaks down quickly in service. Availability of specific sizes is also a cost factor.

Good machinability, high fatigue strength and adequate impact properties are the desired qualities in tool steels. Change of selection of tool steel to improve one of these properties often results in improvement in another. As an example, in cold punching ¾-inch square holes in railroad tie plates, a new tool material not only gave a 100 percent increase in machinability, but also improved punch service life by 30 percent. The steel adopted in this instance was a silico-manganese shock type containing sulfur for machinability and lead. The lead addition serves as an internal lubricant which decreases punch galling and metal pickup. For hot punching a similar part, a molybdenum high-speed steel containing sulfur additives was selected. In this application, the machinability was increased by 30 percent with tool service life increased about the same as in the cold punching operation.

Many tool engineers believe that sulfur additives contribute to brittleness and, therefore, alloys containing sulfur fall short of providing consistent and reliable service in high production applications. However, no detrimental effect has been noted in service life because sulfur steels were used. This brings up another point—a tool material should not be bypassed without investigation because it has a seemingly undesirable quality.

**Tool Design Factors:** Clearance between die and punch is one of the most important factors in design. To a great extent, the clearance determines the life of the punch and die, the quality of the work being fabricated, the power requirements of the press, and the stress in the press during the punching cycle. Die clearance must be varied in accordance with the thickness, alloying constituents, hardness and complexity of the work. Expansion must be considered when hot punching.

When a punch contacts the workpiece, pressure is exerted at the piercing surface of the punch. An equal and opposite pressure starts to build up from below at the die-cutting edges. Along a plane passing through the cross section of the work, slip occurs at the instant that the two opposing forces have exceeded the material yield strength. The angle

*Senior member ASTE Calumet Area chapter.

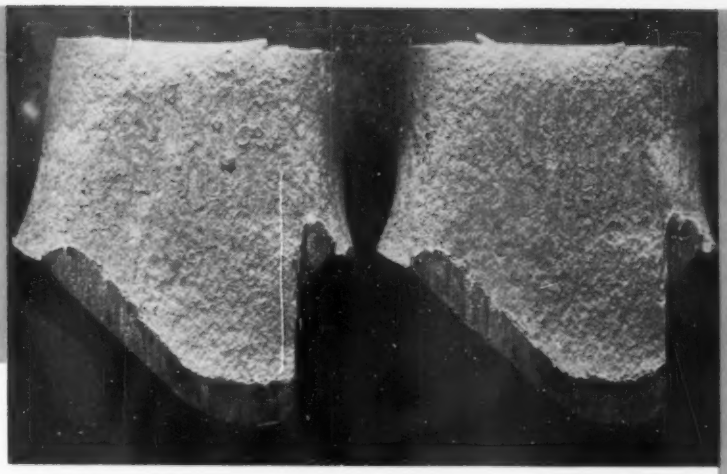
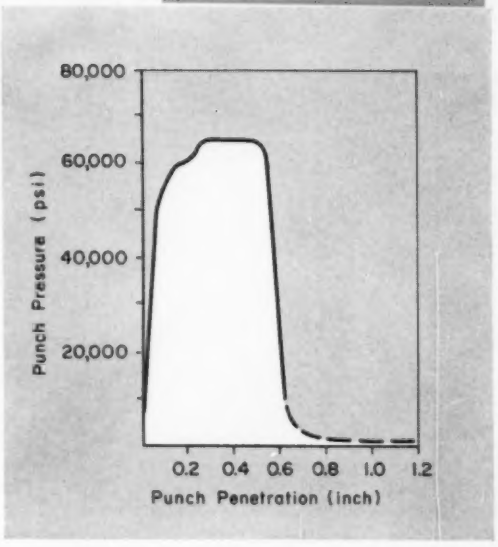


**Fig. 1. Slugs taken from a cold punching operation with proper clearance between punch and die. Metal is sheared cleanly. Irregular shape of bottom is due to part contour.**

**Fig. 2. (below) Approximate machine load curve of punching operation shown in *Fig.* 1.**




at which the slip and shear plane appears is related to the material thickness and the complexity of the workpiece. The compressive yield strength of the workpiece material may also be a factor. If this normal shear angularity is not provided for with clearance between the piercing edges of the punch and the cutting edges of the die, power requirements for piercing are high and punch life is short.

*Fig.* 1 shows slugs taken from a cold-punched railroad tie plate punched with proper clearance between the punch and die. There are no excessive fissuring, no objectional burrs and no slug pulling. *Fig.* 2 is the approximate machine load curve for this example. The initial rise in the curve represents compression of the blank; the flat portion shearing of the material; and the sharp downward slope release and ejection of the slug. *Fig.* 3 shows slugs that have been punched out with insufficient die clearance. These exhibit bad fissuring, burrs at the top where the punch entered the material and slug pulling. The machine load curve, *Fig.* 4, shows that a high punching force is required and that considerable force must be exerted to eject the slug from the die. For comparison purposes slugs produced with excessive die clearance are shown in *Fig.* 5. Here again, as with insufficient clearance, fissuring is present.

The actual clearance specified for the tools to punch the shoulder section of the part shown in the photographs results in a 5.5-degree shear plane angle. This represents roughly 10 percent of the section thickness per side. Through the "gage" and "field" sides of the plate, a shear plane angle of 4.5 degrees is provided, which represents about 7.8 percent of the section thickness per side. Cold and hot section clearances are determined by observing the shear angle of the slugs and adjusting to avoid fissuring, slug pulling and distortion.

**Heat Treatment:** To avoid problems resulting from heat treating, internal stresses must be "designed out" or kept low enough so that tool life will not be impaired. Uneven cooling from heat-treat temperature causes stresses. Sections of tools should be as uniform as possible to allow heat to be dissipated into the quenching media uniformly.

If the mass of a one-piece tool or die is too large to permit uniform cooling, the possibility of making the part as an assembly of several pieces must be considered. Holes, drilled when die design permits, improve the circulation of the quench medium. Elimination of sharp re-entrant angles and provision of generous fillets also improves flow of quenching medium and reduces eddying and foaming. Where sharp edges are necessary, the designer should strive to make these as far as possible from hold-down bolt holes, to avoid cracking through from stress point to stress point.

Fig. 3. Slugs taken from a punching operation with insufficient clearance between punch and die.

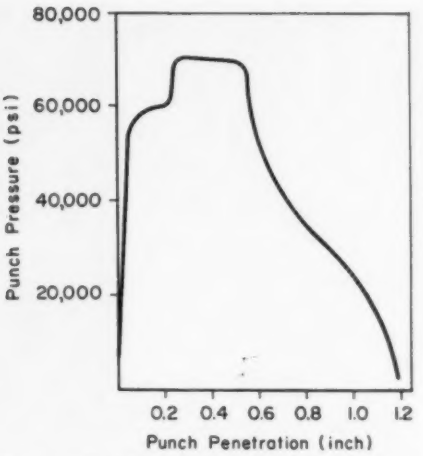



Fig. 4. Machine load curve resulting from punching operation shown in *Fig.* 3.

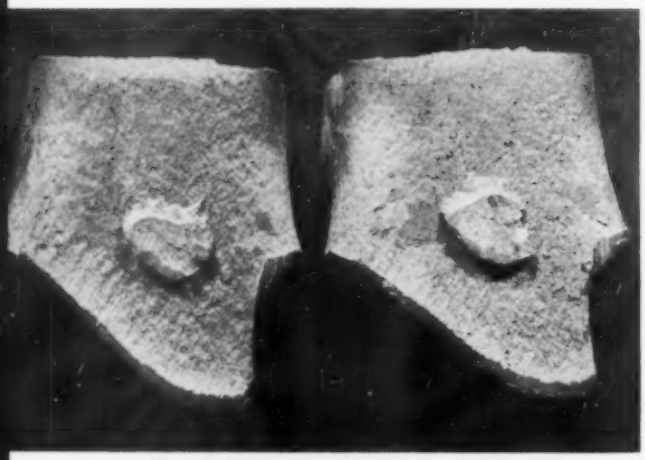


Fig. 5. Slugs taken from a punching operation with excessive clearance between punch and die. Fissuring is present. Machine load curve fell between those shown in *Figs.* 2 and 4.

Silico-manganese tool steels, which are susceptible to decarburization, are carefully heated in an atmosphere-controlled furnace. In the case of the punches and dies previously discussed, time and temperature are governed by the tool steel supplier's recommendations. Punches are quenched vertically in a brine solution. They are then drawn back in an electric furnace to a hardness of 56 to 58 $R_C$. The dies are quenched in oil which is circulated by a motor-driven propeller then drawn to a hardness of 54 to 56 $R_C$. The die profile acts as a stress raiser so maximum toughness must be obtained.

Molybdenum type high-speed steel punches and dies are preheated in an electric furnace, brought to higher heat in an atmosphere-controlled gas furnace and quenched in agitated oil. Final hardness after drawing is 54 to 56$R_C$.

**Finishing and Assembly:** Hardened steel must be ground with utmost care. Many tool failures result from faulty grinding which superficially draws the temper and produces stress raisers. Belt grinding of cold punches parallel with the shank eliminates transverse marks which cause galling and metal pickup. Any decarburization present is also eliminated in this way. It has been found that a relatively coarse finish holds lubricant better than a fine finish. Grinding dies to fit die sockets eliminate tool marks which act as stress raisers.

The molybdenum high-speed punches are not ground since it has been found that the surface oxide gives better service life in hot work applications where no lubricant is available to cool the tools.

At assembly, tools should be checked for quench cracks, stress raisers, hardness and clearances. Die blocks should be checked for cold worked impressions at the punch and die seat; the inserts checked for hardness, finish and fit. The condition and calibration of all liners should be observed. Cold abraded areas should be removed by grinding and poor identification stamping removed.

Before a die is set up in a machine, the die setter should make sure that presses are in good alignment and electrical equipment in working order. When tools are in place, inching the rams downward avoids misalignment damage.

**Service Records:** A record made of all tools and machine parts when they are put in service helps to establish life expectancy trends. Immediate steps should be taken to preclude recurrence of premature failures. Adequate service records and prompt attention to corrective procedures reduce spare part inventories and machine downtime.

Fig. 1. Turbine wheel mounted in lathe for contour machining. Dark lines are machined edges of wheel blades showing through low-melting point alloy workholder.

# fusible alloy workholder solves distortion problem

**By J. Frederick Parr**
**Assistant Editor**

HOLDING THIN PARTS adequately to avoid distortion while machining is difficult when a complex or unusual part shape is involved. An example of such a problem is machining of blade tips of small rotors used in compressors and turbines in jet aircraft, *Fig.* 1, manufactured at Stratos Div. of Fairchild Engine & Aircraft Co.

The turbine and compressor wheels are machined from steel, titanium or aluminum forgings. Straight milling cuts are taken on an angular axis to produce the side faces of the blades. After cleanup between these initial cuts, the blades are bent over a mandrel to an airfoil shape. This curved shape gives rise to the workholding problem.

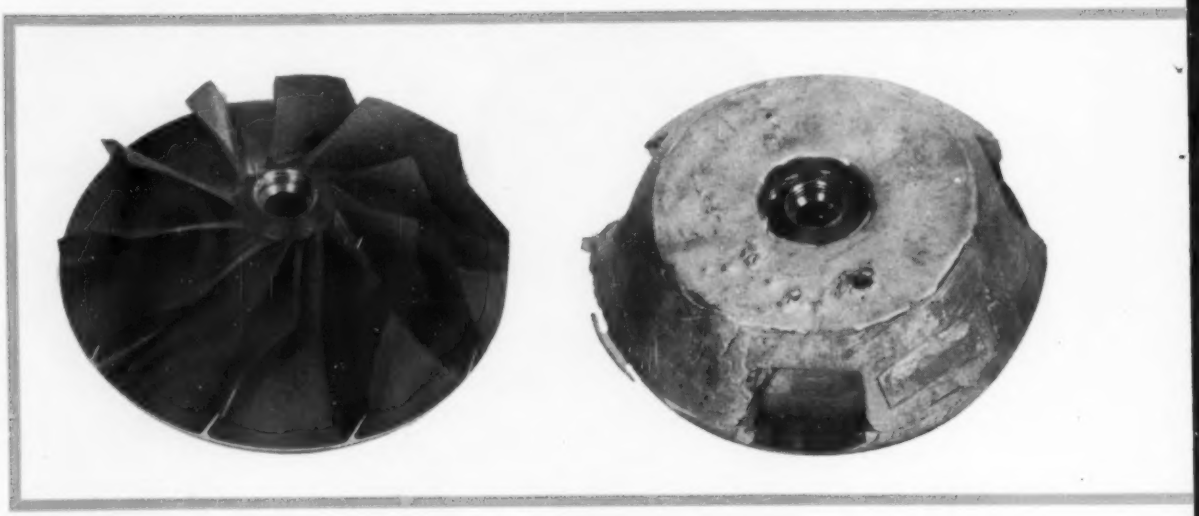


**Fig. 3. Workpiece (left) is invested in alloy, then machined. Completed workpiece is shown at far right.**

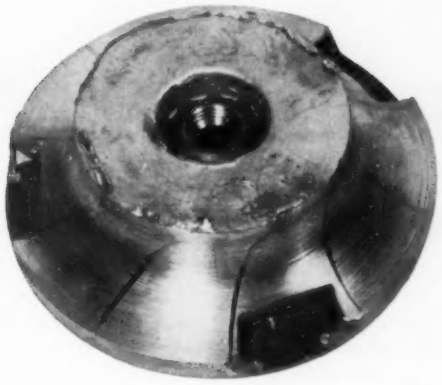
**Fig. 2. Operator pours alloy into jig. Alloy is kept liquid in tank at rear.**

The final machining operation requires several contouring cuts to produce the desired blade configuration. Since the blades are relatively thin, they must be supported while machining. Distortion cannot be tolerated because it disturbs the aerodynamic and balance characteristics of the part, especially critical when it is considered that the parts must operate at approximately 40,000 rpm at high temperature.

**Workholding Method:** The problem of supporting the blades securely while machining was solved by investing them in a low-melting-point alloy. Parts are clamped in a small jig and the investment material is poured in, *Fig.* 2. After removal from the jig the parts are machined. Steps in this process are shown in *Fig.* 3.

Cerrobend alloy (Cerro de Pasco) is used as the

**Fig. 4. Worker removing investment material from workpiece after machining. Steam supplied through hose melts alloy from parts suspended in bucket.**



investment material. It contains bismuth, lead, tin and cadmium in percentages of 50, 26.7, 13.3 and 10, respectively. As is characteristic of bismuth alloys, this metal expands upon solidification and displays slow growth for a time thereafter—an obvious asset in workholding applications. The alloy, a eutectic mixture, melts at 158 F and is kept molten by immersion in hot water. Although it can be cooled quickly by dipping in cold water, parts usually are left to air-cool overnight since production quantities are low. Slow air-cooling has an advantage in this application. Although the air-cooled alloy is not as strong as if water-cooled, it has a larger grain structure which results in better damping characteristics.

**Reclaiming:** After machining, the investment alloy is reclaimed by immersing workpieces in a steam bucket *Fig.* 4. The metal is removed cleanly. Some hand scouring may be required on anodized aluminum workpieces. The chips from the machining operation are also reclaimed. After collection the chips are dumped into a drum fitted with a lift-out basket. Steam is introduced into the closed drum through a pipe melting the investment alloy. Since the specific gravity of the alloy is higher than that of steel, steel chips float on the top of the molten alloy and are removed with the basket. The clean alloy is drawn off through a spigot at the bottom of the drum. An estimated $3000 to $3500 worth of material is reclaimed from chips yearly.

## Water Conservation Program Pays Off

SEVERAL NOVEL IDEAS to reduce the waste of water at the Westinghouse Electric Corp.'s general purpose control department in Buffalo, N. Y., resulted in a savings of more than 15,000,000 gallons of water per year.

For example, large quantities of water are used in the plating room and, during lunchtime, to shut off water at each tank was impractical because of the great number of tanks involved. Therefore, an electrically timed, air-operated valve was installed on the four-inch water main which supplies all the water for the plating operations. Now, water is automatically shut off, and this idea resulted in a savings of 4,000,000 gallons of water per year.

Another 2,620,000 gallons of water per year was saved by using a control unit, called Solu-Bridge Controller, on the rinse tank of the horizontal barrel cadmium line. The controller maintains the rinse tank at high purity without a full-flow water line by having a solenoid-operated valve controlled from the conductivity of the water. In the rinse tank, as the cadmium salts build up to an undesirable level, the conductivity increases to an amount to activate the solenoid. The valve opens and water flows to reduce contamination.

In addition, a saving of 3,700,000 gallons of water per year resulted from back-flowing water from the acid rinse tank into the alkali rinse tank. The acid neutralizes the alkali and thereby improves the effectiveness of the alkali tank. Simultaneously, this eliminates the continuous water flow into the alkali rinse tank.

# improving diamond wheel

**By R. G. Weavind**
**Director of Research**
**Diamond Research Laboratory**
**Johannesburg, South Africa**

**Man-made diamonds give somewhat better results than natural diamonds in resinoid-bonded wheels. This superiority is due to the greater friability of man-made diamonds. Tests show, however, that natural diamonds in needle and plate forms give equally good results and that natural diamonds in block forms are superior for applications where metal-bonded wheels are used for production.**

DIAMOND WHEELS, like other tools used by industry, are continuously studied and tested. Laboratory tests have often resulted in the development of wheels that give improved efficiency in service. In making such tests, every effort is made to isolate significant variables that affect performance. This was the case when 145 resin-bonded diamond wheels were tested at the Diamond Research Laboratory. The results indicated that the normal laboratory method of testing these wheels gives misleading results unless special precautions are taken.

**Test Method:** Three Jones and Shipman production grinders were used for the tests. Each grinder was equipped with a ball-bearing wheel head to enable the wheel to be operated at speeds up to 6500 fpm. Most tests were conducted at 5500 fpm, since this is the peripheral speed generally employed in grinding with diamond wheels. Wheels used were of the D1A1 (DIT) type, 6 inches in diameter, $\frac{3}{16}$ inch wide, with a $\frac{1}{16}$-inch depth of resin. Grit concentration was 100.

Wheels were tested by traversing them across 24 tungsten carbide blocks, each $1\frac{1}{2}$ x $\frac{3}{4}$ x $\frac{1}{2}$ inches. The blocks were cemented together on a cast-iron base to form a 6 x 3-inch specimen. There were 50 traverses in each direction; 100 passes in all. At each change of direction the wheel was fed down either 0.001 inch or 0.0005 inch, depending on whether the grit in the wheel was coarser or finer than 200 mesh Tyler. Crossfeed for each traverse was at the rate of 0.050 inch per stroke. Table speed was maintained at 44 fpm.

Results were expressed as a ratio of the volume of carbide removed to the volume of wheel wear—the "efficiency ratio." With each test the wheel was reduced by 0.010 to 0.020 inch in diameter and the carbide was worn down by 0.090 or 0.080 inch.

Measurement of wheel wear was accomplished with a toolmaker's microscope. It was found that micrometer measurements were too inaccurate since they are affected by heat expansion of the wheel and by the protrusion of diamond particles from the wheel face. The microscope was used to measure the distance from a scribed datum line on the wheel to the outer edge of the resin bond. All readings, of which there were eight per wheel, were checked by two operators; accuracy was within two percent. Carbide wear was measured by a depth micrometer, also to an accuracy within two percent.

Despite this accuracy of measurement and close control of all other conditions, it was found that results were not consistent, even with the same wheel and workpiece. Other variables were investigated.

**Workpiece Variations:** A series of grinding tests on a number of specimens indicated that the first tests on each specimen tended to give a high result, whereas the second and subsequent results were always lower. It made no difference whether wheels containing man-made or natural diamonds were being tested. Sometimes the last of the seven or eight runs on each specimen also gave a high result, particularly if the specimen was worn thin by previous runs. This, together with the high result from the first test, indicated that there was a hard skin around each piece of tungsten carbide that was

# efficiency

ground away more easily than the softer material at the center. Hardness measurements confirmed this variation. To overcome the effect of the hard skin, before further tests approximately $\frac{1}{10}$ inch was ground off the top of each specimen and tests were completed before the last $\frac{1}{10}$ inch was ground away. This procedure eliminated one variable.

**Wheel Variations:** Variation in the hardness of the test specimens was only one factor affecting wheel efficiency; the tests also disclosed that there was a considerable variation in grinding wheels. Unexpectedly poor results from one series of tests were caused by the fact that the resin had not polymerized to a sufficient extent. This was corrected by reheating the wheels for additional curing of the resin.

Two grades of resin were employed for most of the tests—a hard grade and a soft grade. The grade of resin had a marked effect on the results with man-made diamonds but had little effect on the results obtained with the type of natural diamond grit ordinarily used in grinding wheels. For example, a normally shaped natural grit set in a hard grade of resin showed only 10 to 15 percent increase in efficiency as compared with the same grit in a softer bond. Performance of wheels with man-made grit was improved by a greater percentage.

The reason for this increase was apparent when grinding sludges were examined, *Fig.* 1. As one would expect, the grit from the sludge is composed of both coarse and fine particles, but the grit from the natural diamond wheels contains many more coarse diamond particles than the man-made grit. A resin bond, whether soft or hard, is not able to hold natural grit particles (which have smooth sur-

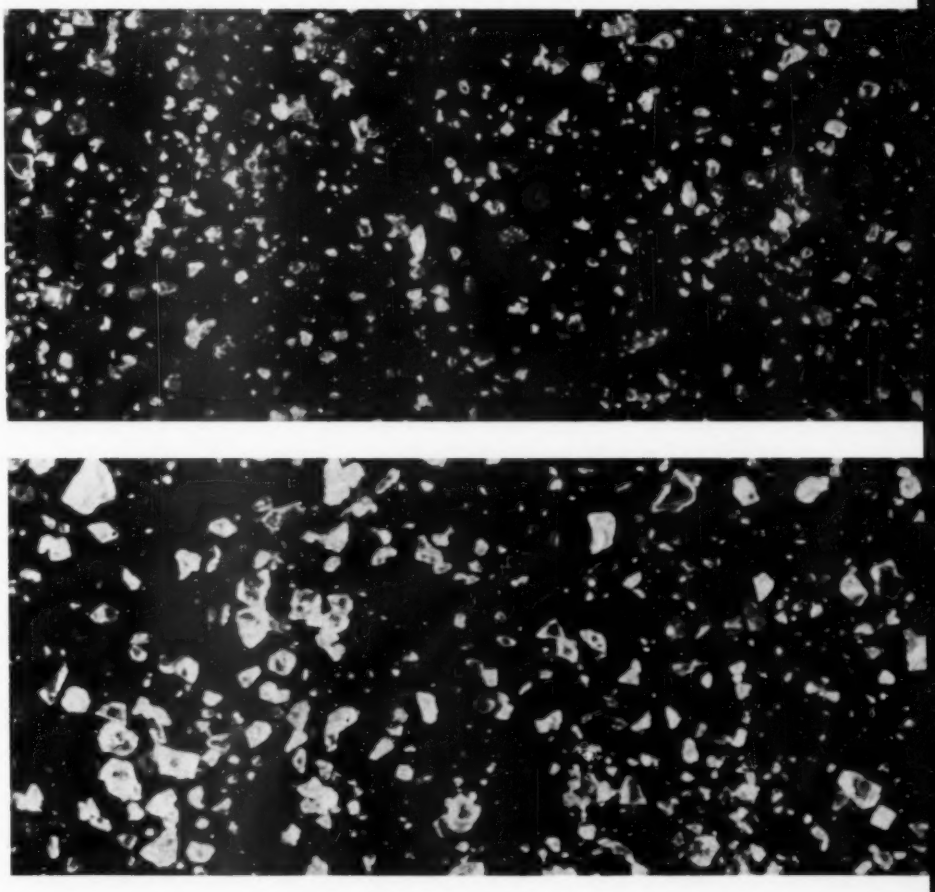


**Fig. 1. Diamond particles recovered from the sludge after grinding with a wheel made with a soft grade of resin containing man-made diamond grit are shown at top; sludge obtained with natural grit under the same conditions is at bottom. In general, the natural diamond particles are larger and smoother.**

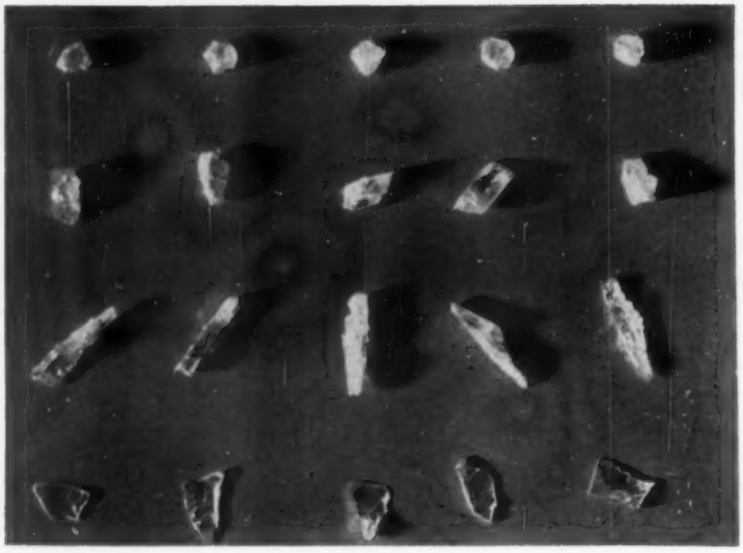


**Fig. 2. Types of particle shapes produced by crushing natural diamonds — cubic, rectangular, needle-like and flat plates. The needle and plate forms are more friable (break more easily) than cubes and rectangles.**

faces and fairly regular block shapes) efficiently. The predominance of fines in the sludge from wheels containing man-made diamonds indicated quite clearly that the irregular shapes of the particles in the grit from man-made diamonds enabled them to be more firmly held in the wheel. Man-made diamonds are friable and this friability causes the grit to break down into small pieces instead of being dislodged in larger pieces, as is the case with conventional natural grit. Therefore, the man-made diamonds stay in the wheel longer during grinding.

**Special Natural Grit:** It was apparent from the tests that if relatively friable natural diamond particles with rough or irregular surfaces were used in resin-bonded wheels, the results should be better than with the type of grit normally employed. The elimination of blocky particles, which are easily dislodged from the resin, would, it was thought, lead to further improvement. Accordingly, a program to develop a suitable natural grit was started.

Due to variations in the hardness of the tungsten carbide test pieces, an improved test method was adopted. Each wheel was used to grind each specimen once in a sequence arranged so that each wheel ground at a different level in each carbide specimen.

The four principal shapes of diamond particles produced in crushing are shown in *Fig.* 2. Some particles are cubic, some have a rectangular shape and others are needles or flat plates. A method of separating the various shapes from one another has been developed.

Tests with the various shapes showed that the more blocky the particles in a resinoid wheel, the poorer the results. In one series of tests, with very blocky shapes, the efficiency ratio was 14; with a mixture of needles and blocks, the ratio was 22; with a mixture of needles and flats, the efficiency ratio was 25. Surface finishes obtained with the needles and flats were virtually the same as those obtained with conventional particles.

In tests run with coarse, medium and fine grits, the improvement in the efficiency ratio with the special grits was outstanding. With coarse grits, the improvement was 44 percent; with medium grits, it was 36 percent and with fine grits, it was 42 percent. All tests were run at 5500 fpm.

Blocky particles find their best application in metal-bonded wheels and in saws. Operating pressures with metal-bonded wheels and saws are, in general, much higher than in resin-bonded wheels, due to the tough nature of the bond. Since blocky particles of natural diamond can be firmly held in metal bonds, full use can be made of their strength and resistance to abrasion. They protrude from the bond and protect it. More friable particles, on the other hand, tend to break down level with the surface of the bond and the wheel cannot cut.

# THREAD ENGAGEMENT
## *for maximum bolt strength*

**By O. W. Wehrle**
**Strength Section**
**Douglas Aircraft Co., Inc.**
**Santa Monica, Calif.**

REALIZATION of the maximum strength of each component is essential in rocket and missile design. Thus it is desirable to know what length of engagement is necessary to take full advantage of the tensile strength of threaded bolts. The curves on the following page give this information for various bolt strengths.

The curves show the relationship of the length of thread engagement to the ultimate strength of the nut material and represent the minimum engagement required to develop bolt rated tensile strength. No fitting or casting factors have been included. The rated tensile strength of bolts is based on developing minimum heat-treat ultimate strength on the area calculated using 98 percent of the pitch diameter. This strength is higher than the usual strength allowable but is in better agreement with the actual strength of the bolts. Thread engagements to the left of the vertical cutoff lines are critical for bolt thread shear. Those to the right are critical for nut thread shear.

The curves were derived by computation with the following equations:

$$\frac{A_s}{L_e} = \pi n\, K_n \text{ max } [1/2n + 0.57735\,(E_s \text{ min} - K_n \text{ max})]$$

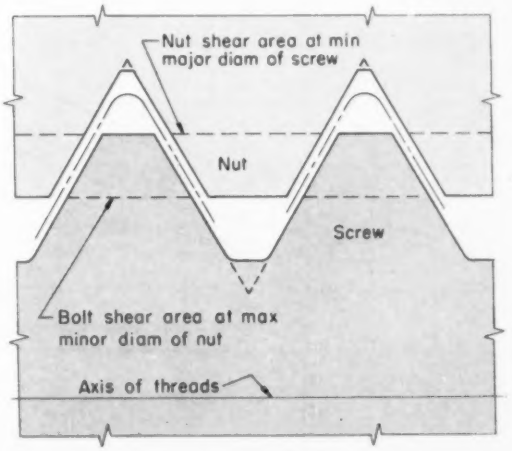
and

$$\frac{A_n}{L_e} = \pi n\, D_s \text{ min } [1/2n + 0.57735\,(D_s \text{ min} - E_n \text{ max})]$$

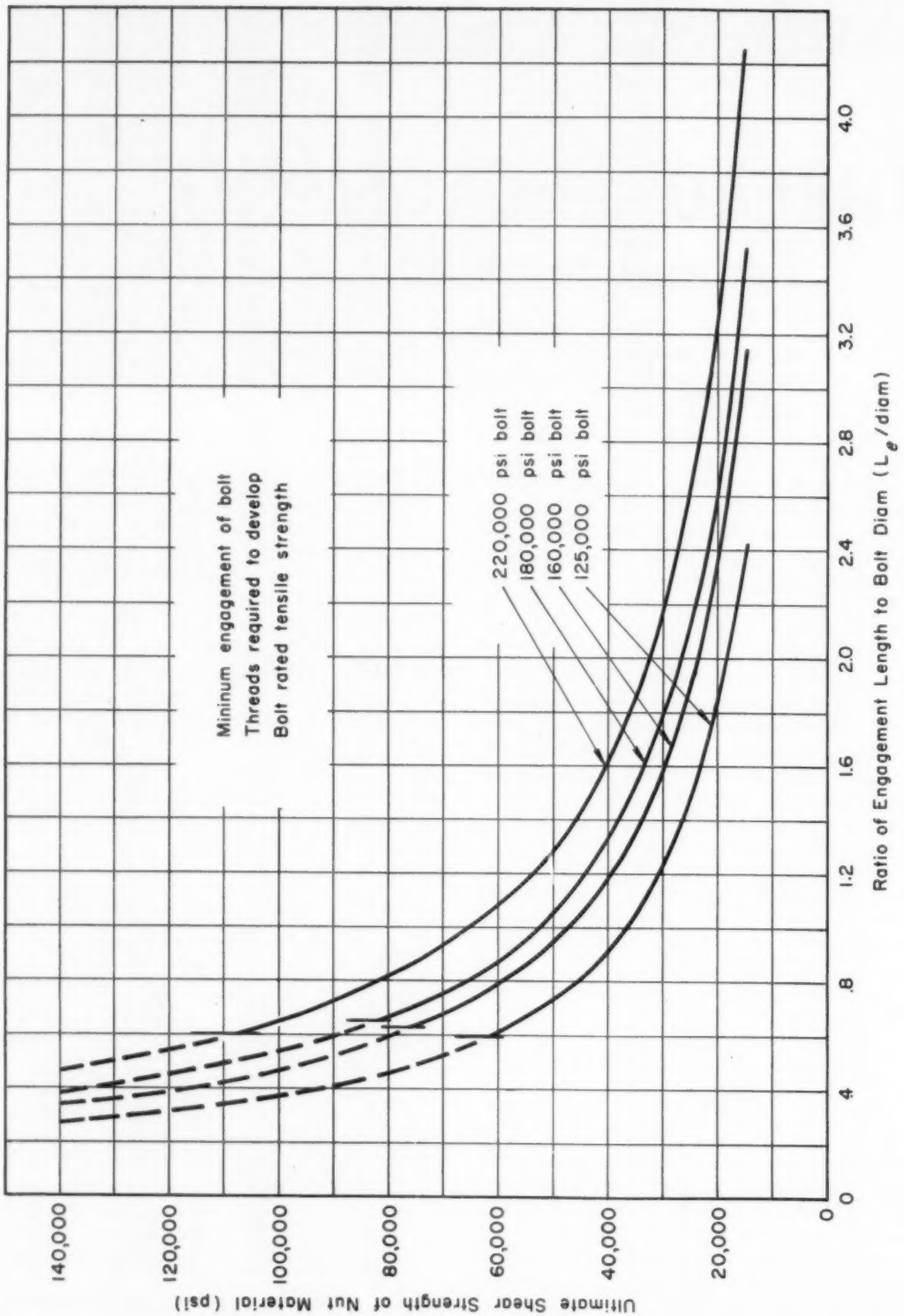
where $A_s$ = shear area of external thread, $A_n$ = shear area of internal thread, $n$ = threads per inch, $L_e$ = length of thread engagement (inch), $K_n$ max = maximum minor diameter of internal thread (inch), $E_s$ min = minimum pitch diameter of external thread (inch), $D_s$ min = minimum major diameter of external thread (inch), an $E_n$ max = maximum pitch of internal thread (inch). The accompanying diagram shows areas used for computations.

These equations may be found in various handbooks under discussions of thread engagement. One such source is *Machinery's Handbook*, 16th Edition, The Industrial Press, N. Y., 1959.

Thread tolerance used in the calculations were those for class 3A bolts and class 2B nuts. For computation purposes, a condition of similar strength materials for bolt and nut was assumed and an average ratio of engagement length to diameter was used to calculate the $L_e$ diameter ratio for various combinations of materials used with the different strength bolts. The curves were then developed to cover a workable range of ultimate shear stresses for nut materials.




**Thread engagement areas used for computations.**


Minimum engagement of bolt
Threads required to develop
Bolt rated tensile strength
220,000 psi bolt
180,000 psi bolt
160,000 psi bolt
125,000 psi bolt
Ultimate Shear Strength of Nut Material (psi)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
0
.4
.8
1.2
1.6
2.0
2.4
2.8
3.2
3.6
4.0
Ratio of Engagement Length to Bolt Diam ($L_e$/diam)

# ASTE news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# Members in the News

EUGENE MAKIE, secretary of the Detroit chapter, has been appointed general manufacturing manager for the Utica Div. of Curtiss-Wright Corp., having served as manager, manufacturing engineering special products with the Wright Aero Div. Prior to joining the company, Makie was with Ford Motor Co. as manager of manufacturing engineering at the Dearborn Engine plant.

ARNOLD A. WILCOX, Santa Ana member, formerly consultant with "Varec," has been appointed vice president-manufacturing for The McCarty Co., Los Angeles. Wilcox has held executive positions with such firms as Brown Citrus Machinery, National Gypsum Co., General Motors Corp., Acme Winter Corp., and Michigan Design and Engineering Co.

Associated with Sandvik Steel, Inc., for the past four years at Fairlawn, N.J., ERIC G. MESSLER of Paterson Chapter has been elected president and general manager of Sandvik Canadian Ltd. with headquarters in Montreal. After 10 years' service in Sweden with Sandvik's parent company, Messler was associated with Sandvik Canadian Ltd. for six years —as vice president for the past three years.

General Motors Co. announces the promotion of RICHARD H. FRYE, Western Reserve chapter member. Frye started with the division as a General Motors Institute student following graduation from high school in 1942, received his B.S. degree in 1947 and was assigned to the tool and process engineering department as a die designer. In 1951 he was named senior die designer and was promoted in 1955 to chief tool designer in production engineering, a post he held until his recent assignment as supervisor of motor plant production engineering.

HARRY BILL, JR., Detroit, has been appointed vice president in charge of sales at Michigan Tectronics. He will be responsible for field operations of the engineering and manufacturing divisions. Bill was formerly associated with Crucible Steel Co.

John L. Epps

J. W. Murphy

Eugene Makie

Western Instruments Div. of Daystrom, Inc., has appointed JOHN W. MURPHY manager of operations, in which capacity he will be directly responsible for engineering, manufacturing, and industrial relations, and have charge of the division's main plant in Newark. Prior to his appointment, Murphy had been with IBM Corp. for 14 years, three of which he served as engineering manager. He is a member of Mid-Hudson chapter.

EUGENE P. CUNNINGHAM, Chicago, has been named vice president of the Clearing Div. of the U. S. Industries, Inc. Cunningham has been with the Clearing organization since 1934 when he joined the engineering department. He was appointed general sales manager in 1952 and two years later, vice president-sales in charge of the company's foreign affiliations.

Tommy Tomlinson, chairman of the San Fernando Valley chapter, has been appointed to the West Coast sales staff of Firth Sterling, Inc.

Webster Mfg. Co., Inc., manufacturer of marine and other types of mobile antennas, has appointed EDWARD LITTMAN, Golden Gate, general manager. Littman comes to Webster from Lynch Carrier Telephone Systems and Applied Electronics Co., Inc. His experience has been in electronic and mechanical engineering, as well as in industrial sales.

Michigan Tool Co. announced the appointment of L. W. SHEEHY and J. C. MCFARLIN, both of Boston chapter, and H. B. GUMOND, Fairfield, to represent the firm in the New England states. . . . Announcement has been made by Triangle Mfg. Co. of the appointment of JOHN L. EPPS, Fond du Lac chapter, as plant manager. Epps was previously plant manager for Filter Supply Corp., Winona, Minn., and prior to that he served with Electro-Motive Div. of General Motors Corp. at LaGrange, Ill., for 13 years. . . . Stambaugh Supply Co. has appointed HARRY J. GREEN, member of Chicago chapter, operation manager in charge of sales. Green comes to Stambaugh from Boyd-Wagner Co., where he served in a similar capacity. . . . Formerly associated with Chrysler Corp. and E. I. duPont, FRANK E. CARPI of Philadelphia chapter has joined the Aerojet-General Corp. in Sacramento. His new job puts him in charge of inspection tooling for all missiles produced in the solid rocket plant.

# 6000 Products . . . 1300 of them new . . . due at the tool show

by Eleanore Vinall
assistant editor

DROP IN at Headquarters any day before the 21st of April, 1960. Ask for Len Abrams. Then—find a comfortable chair, pick up the current issue of THE TOOL ENGINEER, and settle back to wait.

Leonard Abrams, the ASTE's exposition manager, is probably the busiest man in the Motor City. He has been—all year. It would take a team of researchers to estimate how many hours of thought and planning, hundreds of personal visits, thousands of telephone calls, and millions of pieces of paper carrying information, instruction and correspondence have passed through Len's head and hands since March of 1957 when he began work on the 1960 Tool Show.

It takes a heap of planning—and plain, old-fashioned hard work—to prepare for an influx of 530 exhibitors with more than 6000 products to display and operate—and the 35,000 visitors and buyers of machines, tools and associated products who will come to see them.

### First Showing for 900 Products

Any way you look at it, the 1960 ASTE Tool Show is big: the largest industrial exhibition on record, exceeding any yet held in New York's Coliseum. Exhibitors estimate the value of the products they will show in the multimillions. These products will fill the seven acres of floor space in Detroit's Artillery Armory.

More than 1300 of the products to be shown next April are new since last year's Tool Show. Of these, some 900 are being exhibited for the first time anywhere.

The Detroit Convention Bureau is acting as housing agent for Tool Show visitors and exhibitors. Five thousand rooms in hotels and motels have had an "ASTE-reserved" stamp on them for months.

Out at the Armory on Eight Mile Road, the city's north boundary, a caterer is preparing to serve more than 4000 meals a day in the cafeteria.

Twenty-one major contractors have been signed to provide services to exhibitors. Included are 300 private telephone lines; air, gas, steam and electric power; furniture, drapes and floor coverings; water and drains; signs, badges and special booth equipment; floral displays and photography; plumbing, carpentry, rigging, painting and general labor.

### Exhibitors' Poll Shows High Hopes

According to Harry E. Conrad, executive secretary of the ASTE, enthusiasm is the keynote of the '60 show. More exhibitors have reserved bigger booths more rapidly than ever before. The show's theme, "Tooling for Productivity," is at work in spirit and reality on every level of show-connected preparation.

With this year's upswing in employment and economic conditions across the country, manufacturers and customers alike are optimistic about sales in the decade ahead.

Late this year the ASTE's public relations director, Leo Koester, undertook a survey of exhibitors. In answering the survey questions, manufacturers said that their products, depending on type and application, would increase productivity as much as 2000 percent. (This top figure came from a man who hopes he can gage the future with as much precision as he can make gages.)

**Tool Show Manager Leonard Abrams is the center of activity at ASTE Headquarters these days. Here—phone in hand, paper in hand, many things in mind—he holds a conference on exhibitors' problems in connection with the big ASTE show coming up next April. At his side is secretary Lee Lewandoski and, at the drawing board, Assistant Show Manager Anthony E. Downey.**

Manufacturers foresaw a market expansion of up to 1000 percent in the five-year period just ahead. From '65 to '70, the forecast is for expansion up to 3000 percent over this year's market.

Manufacturers who responded to the poll listed the major problems facing themselves and their customers as (1) inflation; (2) labor and union difficulties; (3) unfavorable depreciation allowances; (4) overtaxation; (5) lack of investment capital in smaller companies; (6) foreign competition; (7) too much government regulation; and (8) unenlightened management.

(You'll be reading detailed information, quotes and suggestions for improvement from this survey in future pages of THE TOOL ENGINEER. Watch for them; they may prove helpful to *you*.)

### First Detroit Show Since 1941

Twenty-one years have passed since the first ASTE Show was held in Detroit in 1938. The city and state, which haven't seen a Tool Show since 1941—before Pearl Harbor—are excited. More than 125 Michigan corporations will exhibit at the '60 show. There'll be more in the future, for the ASTE membership has voted to hold the Tool Show and convention in Detroit every two years.

Questioned about the vast, complex project, Harry Conrad said:

"The Tool Show plays an important part in fulfilling the educational obligation of the Society to gather and disseminate information on the science of tool engineering.

"By providing a showcase for new methods and a forum for new ideas, the Society is rendering a valuable service to industry and to ASTE members.

"Gathered together under one roof will be the most modern methods, processes and tools for the visitor to study and compare. Seventy-five percent of the visitors will be there to find an answer to a specific problem.

"Exhibitors also get an education. In a recent show, one exhibitor learned of 17 new uses for one of his products from the visitors."

There'll be something at the Tool Show for every ASTE member—new products, new ideas for the application of products, exchange of information with other men in every area of tool engineering, old friends to meet and new ones to make.

On the education and ideas front, Leslie Fletcher, ASTE research and program director, is setting up technical sessions and plant tours of depth and interest.

Other convention highlights will include Detroit Day, Education Day, the Honor Awards dinner and Eli Whitney Lecture, special group luncheons and the annual membership meeting and banquet.

# Detroit . . . Tool Show City for '60 . . .

. . . is the industrial capital of the world. On a per capita basis, no other major city has an equal number of factory workers, nor as large a volume of manufactured products.

. . . is the leader not only in the automotive field but ranks first in the nation in the production of machine tool accessories, metal stampings, gray iron, hardware and industrial inorganic chemicals. It ranks high in wirework, machine tools and office machinery.

. . . uses over 10 percent of the nation's output of finished steel, higher by 14 percent than any other area.

. . . ranks fourth in factory payrolls and value of manufactured products. Average wage or salary of all persons covered by Social Security is higher than that of any other major area.

. . . counted 6221 factories in the metropolitan area in the latest Census of Manufacturers—a jump of 120 percent in 20 years. Detroit factories produced 54 percent of Michigan's output and over 4 percent of the U. S. total.

. . . is served by nine railroad systems, 16 airlines, 200 truck carriers, and as a port is second only to New York in the value of trade entering or leaving the United States.

. . . workers include some of the finest skilled craftsmen in the world. The city leads the nation in production of special tools, dies, jigs and fixtures. Manufacturing, chief creator of the city's wealth, employs a higher percentage of the labor force than in any other major city.

. . . has 4700 industries which create one-twenty-fifth of all U. S. manufactured wealth.

# PAYDAY Paves Way For Careers

To 20 young engineering students, the stroke of that pen in the foreground probably meant the difference between leaving school to earn another year's tuition and remaining to continue their studies, knowing they had sound financial backing. Under the volition of Harry Conrad, ASTE executive secretary, the pen signed the International Education Award scholarship checks pictured. Immediately the checks, totaling $11,000, were sent on their way to the bursars' offices of the colleges, universities and technical schools harboring these 20 intelligent and financially deserving young men chosen by ASTE because of their marked interest and ability in tool engineering. That check on top, by the way, is $700 payable to the bursar at M.I.T. for the 1959-60 scholarship award to student Raymond R. Ambrogi.

# P.S. from St. Louis

A demonstration of plastic being shot into a mold was witnessed by a pair of speakers at the technical session on plastics and by Society President Wayne Ewing. Looking on, as ushers Kathy Malone and Marge Gioia illustrated the ease with which the process could be carried out, were Appy Juras (left), president of Plastic Development & Research, Inc., Ewing and Robert J. Nist, Hartford Machinery Co.

No, they weren't watching "that evenin' sun go down." They were watching the lights come up on Lindell Blvd. as the annual Veiled Prophet Parade got underway. ASTE members and wives claimed the best spot in St. Louis from which to view the colorful pageant—the Starlight Roof on the Chase Hotel. Following the parade the roof-dwellers turned their attention to the equally colorful St. Louis Day Dinner.

A certificate expressing ASTE's appreciation to Carter Carburetor for their cooperation in allowing 48 Society members to tour the plant was given to Lee Fantz (fourth from left), Carter's production manager, by Charles Hawkins of the St. Louis plant tour committee. The presentation took place during the course of the tour as (left to right) Don Krenn, Rudy Kick (ASTE member working at Carter), Robert Nist, Gene Frerichs, Harold Sullivan, and Louis Malpocker, chairman of the plant tours committee, watched.

A break in the otherwise rapid pace set for visiting wives in St. Louis enabled the three leading ladies of the convention to pause long enough for a picture. They are (left to right): Mrs. Erwin Huchzermeier, cochairman with her husband of the ladies' activities committee; Mrs. Wayne Ewing; and Mrs. Charlton Brown, wife of the host committee chairman.

A milestone in the history of ASTE technical publications occurred in St. Louis when the second edition of the *Tool Engineers Handbook* was introduced to the engineering world. Three of the men who made it possible—Frank Wilson (left), handbook editor; Willis Potthoff, chairman of the National Technical Publications Committee; and Philip Harvey (right), assistant editor—point out the main attractions of the new book to Society President Wayne Ewing.

A telegram expressing Missouri Gov. James T. Blair's wishes for a successful Semi-annual Meeting is read by five of the dignitaries present at the St. Louis Day Dinner—(left to right) ASTE Executive Secretary Harry Conrad; St. Louis Host Committee Chairman Charlton Brown; Rev. J. J. Marchetti, S.J., executive vice president of St. Louis U., who gave the invocation; Dr. Ross Trump, keynote speaker from Washington U.; and ASTE President Wayne Ewing.

# Chips and Chatter

When a man spends 20, or 30, or even 40 years with one company, that's fine. But when he spends 60 years with the same company, that's news. Harry Sloan, member of HARTFORD chapter, recently marked his 60th anniversary with The Cushman Chuck Co. of Hartford, Conn. At a dinner honoring the occasion, directors and officers of Cushman presented their veteran chairman of the board with a silver tray and a commemorative album depicting the key role that Harry Sloan has played in the company's growth. Sloan joined the company when he was 19, and he and his father, Adrian P. Sloan, worked their way up through the 24 ensuing years to become, in 1923, the vice president and president of the corporation. Harry Sloan became president when his father moved up to be board chairman in 1928. In 1952, when Harry in turn moved on from the presidency to head of the board, there was a third generation—Harry E. Jr.—willing and able to become president. Largely due to Harry the elder's inventive genius, many designs and innovations, patents and daily shirt-sleeves contributions, Cushman is called the world's largest producer of chucks.

For years Irv Also ran the wheels off his car driving to council and regular meetings of his LONG BEACH chapter. Now he's a wheel himself, and has found out with some satisfaction that he can apply the brakes. For two years he had been driving the Los Angeles freeway system the many miles from his house to the meeting place in Long Beach. Before that, he said, he had taken an over-the-hill route until he finally lost his little foreign car in a ravine on Route 39. This last month, the chapter council meeting took place in—where else?—the chairman's home.

At Monte Carlo night in St. Louis, even the ASTE dignitaries let down their hair. With a studied air of affluence as well as influence, National Director Joseph L. Petz of Pleasant Valley, N.Y., lights up a cigar with a $100 bill. Petz agreed to pose, by the way, because he knows so well the problems of newsgatherers and photographers—he spent seven terms, three as chairman, on the National Editorial Committee. Although the fun and the cigar were real, Petz wants it known his money was fake.

Driving home a punch line during one of the St. Louis Seminannual Meeting's lighter moments is Past ASTE President George A. Goodwin, works manager of the Master Electric Co., Div. of Reliance Electric & Engineering Co., Dayton, Ohio. That's National Director Frank F. Ford of Atlanta, Ga., on the receiving end.

QUOTES OF THE MONTH: "The only animal that keeps running after it dies is the machine tool."—William O. Moeser, Jones & Lamson Machine Co., Springfield, Vt. Speaking at the Second Canadian On-Campus Conference, McMaster University, Hamilton, Ont., Moeser urged a machine replacement formula which takes cognizance of the broad, years-long area of economic failure that lies between equipment when it is new and when it finally reaches the point of no return—physical breakdown.

"We need some Don Quixotes in standardization work. Darn little creativity comes out of committees; real creativity comes from individuals with the courage to tilt at windmills."—Kenneth Stoll, equipment designer, Sylvania Electric Products, Emporium, Pa. A member of ASTE's National Standards Committee and of NORTHWESTERN PENNSYLVANIA Chapter 128, Stoll told the ASA's 10th national conference, held in Detroit, about the Society's standards program.

Smiles came easily at Hartford Night. Here are M. J. Mather, president of Allen Mfg. Co. and toastmaster; Past National President Irwin Holland; guest speaker Albert Waugh of the University of Connecticut; and Chapter Chairman Paul Pick.

# Higher Education Calls for Help at Hartford Night

PRODUCTION is a problem in education as well as in industry. This analogy was forcibly brought home to 308 members and guests at the Executives and Educators Night of Hartford Chapter 7.

"A cardinal—indeed sometimes a deadly—sin of industry is to fail to develop its production potential. Similarly, the worst thing a society can do is to fail to develop its intellectual potential."

The speaker at the Oct. 5 meeting in Hartford's Hotel Bond was an eminent educator in the state of Connecticut, Albert Waugh, provost (vice president) of the University of Connecticut, Storrs.

"The real pressure of the so-called population explosion has not yet fully reached the college level," Waugh said. "The alarming fact is that last fall's big college population came from the year of *lowest* birth rate. College enrollments in 1965 are expected to top last June's total by 80 percent. In the state of Connecticut alone, even if all the colleges should build and expand all they now hope to, the doors of higher education would be barred in 1965 to 14,000 persons with college potential."

While production is education's problem of the "flesh," answers to the why of things are the problems of the "spirit," Waugh said. The black-vested, mustachioed, scholarly-appearing professor appealed to the engineers and industrialists present not to overrate science as the answer to all things. Science tells us what but not why, he declared; we still lack the answers to the biggest mysteries of life, and the mark of a well-educated scientist or engineer is his ability to realize this.

Chairman Paul F. Pick presented an affiliate membership certificate to Harry E. Sloan, Jr., of The Cushman Chuck Co., who received it formally in the name of all the chapter's 23 affiliate members. Representatives of the area's leading industries and educational institutions were seated at the head tables. Among ASTE guests at the affair were two national directors, W. J. Pender and Joseph L. Petz; three past national presidents, Irwin F. Holland, Ray H. Morris and Joseph P. Crosby; and, from Headquarters, Education Director Gilbert Seeley.

In accepting the affiliate membership certificate for the chapter's industrial membership, Sloan praised the scholarship program that annually gives one $300 stipend to a University of Connecticut student, two $150 awards to students at Hillyer College, and two more for $150 each to students at State Tech. "The $50 contribution for affiliate membership is peanuts for a corporation," Sloan said. "Why don't you ask for more?"

The superlative toastmaster of the evening was M. J. Mather, president of the Allen Mfg. Co.

Carl W. Moeller and W. H. Gourlie received new editions of the *Tool Engineers Handbook* for their assistance in its compilation.

# Society's Role in Standards Underscored at ASA Meeting

TECHNICAL SOCIETIES such as ASTE have custom-made facilities for drafting national standards because they have an already-established communications system that provides a direct means of finding qualified people and provides a clearing point for collected information, Clyde L. Fanning, vice chairman of the National Standards Committee, told delegates to the 10th National Conference of the American Standards Association.

Reinforcing his statements were four other members of ASTE who have been closely identified with the Society's standards program:

John Rotchford, past chairman of NSC who is standards supervisor for Raytheon Mfg. Co.; Kenneth Stoll, Northwestern Pennsylvania chapter representative on the NSC, equipment designer at the Sylvania Electric Products plant in Emporium, Pa.; Bernard Better, research director of Scully-Jones & Co. who has worked for years on standards for ASTE and on various ASA committees; and George J. McLaughlin, standards head of the Manufacturing Engineering Div., Grumman Aircraft, and an NSC member from Long Island chapter.

Rotchford was chairman of a morning-long session titled "ASTE and Its Engineering Standards," one of eight sessions at the three-day ASA conference held in Detroit Oct. 20-22. McLaughlin, Better, Stoll and Fanning presented papers. Also in attendance, as a member of the ASA program committee, was Arthur Colton, ASTE administrator for standards.

It was the Society's first such representation on the ASA national program. ASA is a federation of 110 technical societies and trade associations who are either member-bodies or associate members, ASTE being in the first category. In addition, ASA has some 2300 company members.

Underlining the Society's past contributions and present concern in the field of standardization are figures released in NSC Chairman Arthur E. Crom's

**Kenneth M. Stoll, "Standards as an Essential Engineering Service":**

**. . . . The only way industry can discharge its responsibility is to undertake a massive effort at getting down to the grass roots and searching out the interest and concern of production people. The engineering service standards must evolve from the production firing line.**

**The ASTE is capable of playing a big role in creation of such practical standards. It is peculiarly fitted for the role, consisting as it does of membership that cuts across all levels of education and experience, from the scientific talent for carrying out basic research to the tool engineers who conceive and man the production lines. The companies represented in its membership are a cross-section of industry, broad enough to encompass the industrial giants and the job shops that may be tomorrow's producing units. It is organized for dealing with standards on a national and regional basis, as well as at the individual chapter level. It can quickly call upon not only its own membership but the thousands of resource people with whom that membership has working contact, to seek opinion and recommendation on standards proposals.**

**George J. McLaughlin, "What the Individual Can Do for Standardization":**

**. . . . Let us assume you recognize a need that could be properly served by an American Standard. What do you do? Locate the nearest branch or chapter of the association or society which serves your industry, first making sure the proposal will benefit both manufacturers and consumers. Submit your request and then offer to serve on a committee to help draft a proposal . . . . to be submitted to the ASA. From that time on, if accepted, it will be in the hands of hundreds of willing, qualified experts. Before that standard is finally promulgated, thousands of people will have had a hand in forging it into a form that will satisfy all concerned; otherwise, an unusable standard would result, which would be no standard at all because most people would just ignore it. Do not expect miracles! It takes time to reach all parties and hear their side of the story, revise the proposal, send it out for letter ballot, and revise again if necessary, until all are heard and satisfied. Only then can it be published with the proper approval of the ASA. . . .**

**It is an act of minor treason, in my mind, to have such an idea or need and then to sit on it.**

**After the four-paper ASTE session at the American Standards Association's 10th annual conference in Detroit, participants stopped out in the lobby to inspect the National Bureau of Standards length-measurement displays. Here, watching a demonstration of Krypton 86 and Mercury 198 lamps, are (left to right) John Rotchford, standards supervisor, Raytheon Mfg. Co., South Lowell, Mass.; Kenneth Stoll, equipment designer, Sylvania Electric Products, Emporium, Pa.; Alvin G. McNish, acting chief of Optics and Metrology Div., NBS, Washington, who explained the display; Clyde L. Fanning of General Motors Institute, Flint, Mich.; George J. McLaughlin, group leader, Grumman Aircraft, Bethpage, N. Y.; Bernard Better, research director, Scully-Jones & Co., Chicago; and (seated, viewing lightwave interference fringes) Ellsworth F. Seaman, head standardization engineer, Navy Bureau of Ships. Krypton 86's orange light is the proposed international standard on which all length measurements will be based, subject to final adoption by the International Conference on Weights and Measures in 1960. Wavelength of Hg 198's green light is the working standard developed by NBS in 1947 and now in world-wide lab use.**

semiannual report and partially covered in Fanning's talk at the ASA gathering. The recapitulation of ASTE activities shows that 46 of the Society's 161 senior chapters are studying new standards projects; 102 are engaged in the just-as-important task of reviewing present standards; 21 reviews of existing standards have been completed and forwarded to ASA this year, 27 last year; 19 ASTE-sponsored standards have been adopted in part by ASA to date this year, 25 last year. ASTE also sometimes works with other technical societies in joint sponsorship of standards.

Stoll, in his paper on "Standards as an Essential Engineering Service," stressed the "grass-roots, firing-line" position of ASTE in the battle for more and better standards and challenged the metalworking industry to make more use of the Society's strategic advantage.

Disclaiming any connection with official ASTE policy, Stoll stated his firm personal conviction that the Society "can serve industry still better if given recognition as a final consensus-gathering group (in its particular fields), cutting valuable years off the time required to process national standards." The ASA, which does not write standards but only develops, approves and promulgates, operates under the consensus principle: an American Standard can be approved only if a consensus of voluntary consent exists among all groups substantially concerned with the standard. A consensus does not necessarily mean unanimous acceptance. Votes are weighed rather than counted; i.e., objection of one important organization may outweigh all other affirmative votes.

In his talk on "What the Individual Can Do for Standardization," McLaughlin said engineers can gain professional stature by seeking ways to cut costs, reduce inventory and widen production application through standards. He listed several present needs: uniformity in descriptions of bandsaw blades (proposed by a group of tool engineers in the Rocky Mountain states); tolerances for ream bushings (being pushed by an East Coast group who have encountered great difficulty in reaming holes using jigs containing drill bushings, since the tolerances on reamers and bushings are identical in many diameters); color codes used with templates in chemical milling; and a uniform three-letter tool code.

Better cited an additional need for a national standard covering spindle noses for boring mills and similar machine tools. He said that each manufacturer has a slightly different arrangement for the location, width, and length of the drive lugs and the keeper keys on the spindle noses he makes.

Another imperative and, according to some people, "almost hopeless" standardization project, Better said, is directed toward bringing some semblance of order and practicality into the present chaotic listing of drill sizes by fractions, whole numbers, letters, millimeters and decimals. Several chapters are working cooperatively on this challenge.

Better summarized some of the reasons why we have good standards, poor ones, or none at all, on

**Clyde L. Fanning, "The Unique Position of an Engineering Society in Standards":**

**. . . . The ASA will approve standards only "if they are accepted by a consensus of national groups substantially concerned with their scope and provisions." In order to provide a true consensus, it is necessary to have (1) a direct means of contacting the people who have the knowledge and experience to make the required contribution, and (2) a clearing point for processing the collected information.**

**The ASTE is so organized that it meets these two requirements for the effective writing of standards, as well as for the review of existing standards. The National Standards Committee of ASTE is in direct contact with the chapter committees. For any standards which fall within the scope of ASTE interest, it is possible to contact at once specialists in each field. . . . Over 100 chapters are doing standards review work at the present time. Forty-six chapters are now studying new standards projects.**

**Bernard Better, "Philosophy Conflict in Tool Standardization":**

**. . . . A standard is a solution to a recurring problem. It is a human trait to be afraid of change and to think that a problem, once solved, should stay solved forever. Life does not follow this pattern. A standard, to be worthwhile using, must undergo changes and therefore must be revised to meet the changes in the problem it was intended to solve. Every standard carries in itself the seeds of its decay and only constant attention and adaptation to changed condition will keep it alive and of service.**

**It may on the surface appear that you have done a good job as far as utilizing standard tools is concerned, but have you really obtained the highest economy? Have you reduced unit costs to a minimum? Quite often it pays handsomely to review what a special tool could do in comparison with a standard. Perhaps the special tool you designed may become the seed or the ancestor of a family of new standard tools.**

**Arthur E. Crom**
ASTE Standards Chairman

tools. He defined a standard as a "practical and repeatable solution to a recurring problem."

The theme of the ASA conference was "Standardization—Keystone of Industrial Progress." In the keynote address, R. H. Isbrandt, director of automotive engineering and research at American Motors, emphasized the national and international benefit of standards but added a stern warning that improperly conceived or executed standards "can also freeze designs, retard engineering progress, and fail to meet the changing needs of the customer."

The development of a standard is an excellent example of the American free enterprise system, he declared. "Only by *voluntary* acceptance of a mutually developed standard can stagnation in design be prevented."

### Metric Versus Inch System Debated

In an effervescent but inconclusive session on "Should American Industry Convert to the Metric System?" the ASA delegates heard most of the pros and cons of a debate that has been going on at least since the time of John Quincy Adams. In 1821, Congress said no.

Proponents of conversion pointed out the trend toward the metric system throughout the world—India and Japan being the latest nations to go metric. The inch-pound users, they contended, are a distinct and shrinking minority and, in the international inch agreement arrived at among English-system countries last July, tacitly admitted the need for a truly universal standard.

Other arguments for change:

- Because of the dual system of weights and measures existing in laboratories, English to metric and metric to English conversions are a constant requirement in engineering computations. This is an unnecessary inefficiency imposed on engineers and scientists, wasting untold manhours.
- Possibilities for errors are multiplied because of the conversion problems.
- Our foreign trade will suffer increasingly.

Opponents of change replied:

- The metric system—with its use of milli-, centi-, deci-, deka-, hecto-, kilo-, meters, grams and liters—would confront English-speaking people with a language almost impossible to assimilate.
- Cost of complete retooling, recalibrating myriad scales, changing headings on report sheets, scrapping billions of dollars' worth of engineering drawings, etc., would be astronomical. One estimate put the U.S. cost at $26 billion.
- Use of the decimal inch, instead of fractional, is the appropriate industry compromise, giving us the same mathematical simplification as does the metric system.

Besides, one opponent of change said, can you imagine a housewife who normally requires a pound of porkchops asking for 453.5924 grams?

It seemed to be the consensus (used in its loosest meaning!) that America would never plunge into the metric pool, but possibly might experience a phasing out of the English system. One panelist declared that "the metric system should make its way into this country strictly on economic merit."

Another interesting suggestion was that U.S. technology assign the conversion chores to computers.

# TOOL ENGINEERS Play Part in Pentomic Army

**By Roger F. Waindle**
Past President (1953-4), ASTE.

On October 8 at the Aberdeen Proving Ground, Maryland, members of the American Ordnance Association—among them many members of ASTE—were exposed to new armaments being developed for use in what is known as a Pentomic Army. "Pentomic," as explained by one of the speakers at the Aberdeen exhibition, is the word coined to describe the new atomic-age Army with its integrated commands. The demonstration, part of the ordnance group's 41st annual meeting, offered proof of the progress the Army has made since applying tool-engineering principles to the conduct of battle. Gone are the cumbersome weapons and the theory that each soldier will get where he's needed by himself. Today it's teamwork and tools.

On display at Aberdeen were conveyances ranging from the wheelless air-mobile and the toy-like "mule" to the newest eight-wheel drive trucks capable of surprising speed and agility over rough terrain. So, too, were the new armored tanks, the self-propelled big guns and the rocket launchers—all mobile and quick-firing.

### Rockets Necessitate Ammunition Advances

Ammunition has also gone through a transformation. The familiar cartridge and projectile assembly have given way to rockets of such wide varieties as the light bazooka charges and the 30-ft-long giants that zoom up toward their target in a peculiarly businesslike fashion. The theory of cartridge-rocket combustion, in which the projectile gets its initial boost from the breech reaction, then gathers speed by a rocket continuation, is put to use and results in guns that are lighter, possess higher velocity and lower trajectory, and are more destructive.

Research in electronics has provided the weapons' developers with more advanced means of actuating guns and controlling both the firing rate and the aim. The accuracy was in evidence at Aberdeen. A 105mm tank rifle opened up. The first shot was a hit at 1000 yards, just as were the next five. The next three direct hits traveled 1500 yards. Bazookas, rifles, machine guns, and rockets all demolished their targets time after time.

Military spokesmen present said that such accuracy, fire power, mobility, and dependability qualifies the Pentomic Army as "first with the most" in regard to national defense: its new weapons are the fastest, the fastest aiming, the fastest firing, the fastest in emplacement, and the fastest away again before enemy detection.

An example of this speed was seen as a helicopter delivered a 900-lb Little John surface-to-surface rocket and set it on a launcher. The rocket then established a fire control center, was fired, folded up, and then, its mission accomplished, was once more carried away by the helicopter. From the time of deliverance to the time of removal only 16 minutes had elapsed.

### AOA President Polk ASTE Member

Many comments emitted from the reviewing stand as the day-long display of U.S. military might drew to a close. One member of AOA, who also wore an ASTE pin, was heard to say, "I'm just glad they're on my side."

Although he was heard and agreed with by all, the man spoke to a gentleman at his side by the name of Louis Polk. Polk is the president of the American Ordnance Association and is also prominent in the American Society of Tool Engineers, being a member of the National Research Committee.

It is not surprising that, as the 60-ton truck climbed onto its transporter, nonchalantly picking up the mounting ramp as it went, more than a few of the viewers let their thoughts stray to the tool engineer in America today, his revolutionary way of thinking—tool thinking—and his effect on weapons production. In great part, the Aberdeen Proving Ground's contributors to national defense are indebted to the tool engineer and his policy of doing things better, faster, more efficiently and, in the case of waging war, more effectively.

Pointing out his homeland to Executive Secretary Conrad is E. J. Headland, secretary of the Melbourne chapter. Heading back to Australia after business dealings in France, England and the United States, Headland stopped at ASTE headquarters in Detroit long enough to say hello and report on the activities of his off-shore chapter.

## Dayton

Eighty-nine members and guests enjoyed a guided tour through Globe Industries which manufactures miniature and subminiature motors and generators for missile and electronic equipment. Two films were shown, "Nike" and "Dewline," one showing the nike destroying a bomber target, the other, a tremendous undertaking of building an early-warning radar system north of the Arctic Circle. The tour and the viewing of the films were part of chapter 18's September activities.

## Catskill Region

"Plastic Tooling for Industry" was the subject for technical discussion at the Oct. 14 meeting. The subject was presented by Mr. Rouviere of Devcon Plastic Steel Co., who pointed out the advantages of plastics being used, not only as a tooling material, but in some cases the only practical material, particularly where limited production runs are concerned. Typical applications, Rouviere said, are tooling masters, mock-ups, patterns, drop hammer dies, gages and jigs.

HOUSTON—Robert Young, engineer at Southwestern Industrial Electronics Div., of Dresser Industries, explains the intricacies of the unit in the foreground which will eventually, by means of short wave, control the operation of ten oil wells in Lake Maracaibo, Venezuela. Listening are members of Chapter 29 who toured the plant in September.

## 187 Members Inspect Varied Operations At Rochester Plant

ROCHESTER—Diversified tool engineering at its best was what the members of Chapter 16 viewed on their tour through the Rochester Products Div. of General Motors Corp. on Oct. 5. The plant, which covers over a million square feet of floor space, combines facilities for manufacturing tubing for GM cars as well as automobile carburetors.

In addition to the principal products, the 187 Rochester members saw plant employees turning out locks, cigarette lighters and windshield wiper blades. Of special interest were the tooling operations on punch presses, machine tools, die-casting machines, tube making and bending equipment, and automated carburetor assembly lines.

The visitors found the tubing department a revelation in the working, forming and welding of sheet steel. The automated equipment bends the strips of steel into a laminated tube, welds the seams, removes excess weldments and copper coats inside and out, thus leaving the tube ready for forming into an automobile gas line, hydraulic line or a condenser coil for a refrigeration unit. The Rochester group felt that this tube-forming equipment with its unusual shapes illustrated outstanding creative tool engineering combined with excellent application of kinematics.

Large multiple cavity dies combined with complex and intricate moving parts are the rule rather than the exception in the plant's products die-casting department. Due to the complexity of the die-cast parts for carburetors and locks, each die is designed with multiple moving parts to eliminate machining operations on the castings.

The carburetor section is completely conveyorized; hence manual handling of component parts, except on the most complex small assemblies, is practically done away with. In most cases parts are conveyorized to the assembly location, there orientated and either machine assembled or placed in the optimum position for assembly by an operator. Here again, Rochester ASTE members saw the results of inspired tool engineering not only in the orientation mechanisms but also in assembly jigs and fixtures. *—O. E. Hosford*

## Seattle

At a recent meeting 38 new members were welcomed to the fold by Chairman Gordon Duncan, after which Membership Chairman Bob Waggener presented each new member with an ASTE pin.

## Chapter 125 Hears Summary of Abrasive Polishing and Grinding

OKLAHOMA CITY—James L. Rice, whose job it is to advise industrial plants as to the most efficient method of employing coated abrasive products in order to reduce their end unit cost, addressed Chapter 125 members at the October meeting. He was assisted by Jay Wilson. Both men work for the Behr-Manning Co.

Rice defined a coated abrasive as a product consisting of abrasive grains held firmly to a flexible backing support of adhesive. Each of the three basic raw materials, the backing support, the adhesive and the abrasive, has an effect on the properties and the performance of the finished coated abrasive product, and each acts to some extent independently of the other two, he said.

Lubricants, greases and grinding fluids can play an important part in the belt grinding process. It has been found that certain grinding fluids can affect the surface finish obtained, the rate of stock removal and the belt life. Some of these grinding fluids serve primarily as coolants and flushing agents to remove heat from the workpiece and to flush away grinding chips. This is typical of the behavior of water and mixtures of water with most soluble oils and rust inhibitors.

The user of the coated abrasive, Rice related, will get maximum satisfaction only when the most suitable product specification is selected, and when the product is used on properly designed equipment under the best operating conditions with respect to support, operating speed and type of grinding fluid or lubricant used.

Performance of coated abrasive belts was limited until a few years ago. Today stock removal can be measured in ounces per pass. Quality surface finish is normal. Tolerances can be held to 0.0002 inch and ink can be ground from a printed sheet of paper.

Coated abrasive, the technical name for sandpaper, has been improved until it is now capable of performing any cutting or polishing job, the speakers said. They listed the advantages of coated abrasives as: less setup time, less reworking and cooler working. Longer belts make for cooler cutting. Even distribution of the grit accounts for finer polishing.

Summing it up for the Oklahoma City chapter members, the speakers said that coated abrasives are cheaper than wheel polishing or grinding because they are faster. They produce fewer rejects because they hold closer to tolerances.

*—Lee Roy Chapman*

Six members of the two engineering groups who gathered for a joint meeting in Worcester and the meeting's guest speaker are pictured before the evening's activities got underway. They are (seated left to right) Robert Morrow, Worcester ASTE chapter chairman; Nevin L. Bean, speaker; Raymond Contrucci, chairman of the SCE chapter; (standing) William Kidd, ASTE chapter treasurer; Alden Maynard, ASTE vice chairman; A. Sheldon Childs, ASTE membership chairman; and Victor Kolash, SCE secretary. *—Roger H. Erickson*

George Biggs (left to right), program chairman; Don Lovelace, chapter chairman; Jim Rice and Jay Wilson, guest speakers, appear pleased over the outcome of the October Chapter 125 meeting which was devoted to a discussion of coated abrasives and their advantages in perferring cutting and polishing jobs.

## Soviet Advancements Told at Joint Meeting

WORCESTER—An annual function, a joint meeting of the Worcester chapter of ASTE and the local members of the Society of Carbide Engineers, took place on Sept. 21 with 85 attending.

Nevin L. Bean, technical assistant to the general manager of the automatic transmission division of Ford Motor Co., addressed the group. His talk described the new machine age now existing in Russia. He told of the strides being made in industrial mechanization and automation. Bean warned that unless the United States rubs the complacency out of its eyes ,the USSR will soon surpass it in the engineering field.

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WINDSOR—An audience of 150 Chapter 55 members assembled for the September meeting at which Andrew Millar, vice president in charge of operations at Chrysler Corp. of Canada, spoke on "The Product Engineer and the Tool Engineer." Flanking Millar at the speaker's rostrum are F. D. Rail, first vice chairman, and Mike Hollo, past chapter chairman. *—Frank W. Shaw*

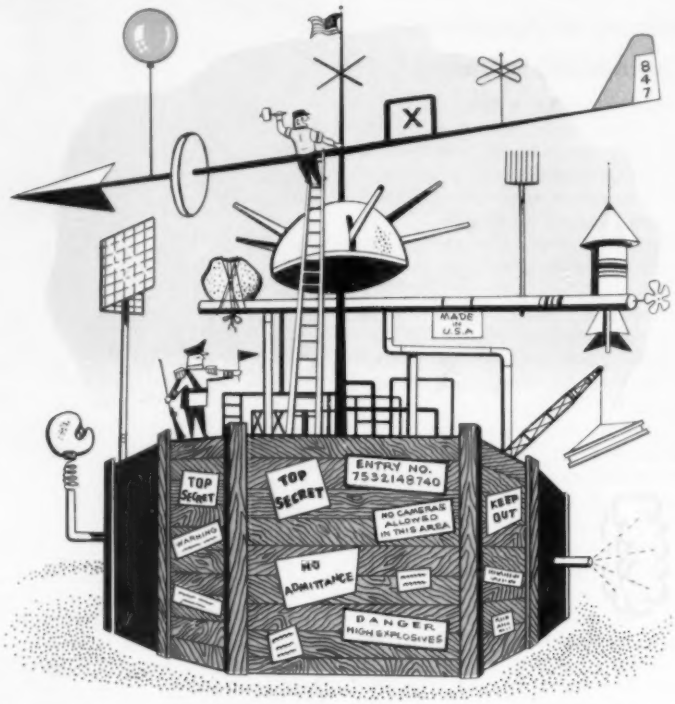
## Two Speakers Review Synthetic Diamonds

NORTHERN MASSACHUSETTS—The close relationship between man-made diamonds and diamond grinding wheels prompted the program chairman of Chapter 100 to recruit two speakers well-versed in both subjects and have them address the membership at one meeting. This dual-subject meeting took place Oct. 20. Norman A. Matthews, manager of engineering, diamond project, General Electric Co., and Richard A. Parke, product engineer, Abrasive Div., Norton Co., spoke on the man-made diamonds and the diamond grinding wheels, respectively.

Matthews talked of the progress and development in the manufacture of diamonds by man. Although today there is little difference between the cost of man-made and natural diamonds, Matthews stressed some of the more important advantages of synthetic diamonds over natural diamonds.

The field of manufacturing diamonds is comparatively new and yet great progress has been made in the last six or seven years, he stated. GE is now experimenting with a process which makes diamonds harder by rearranging the atomic structure of carbon.

Parke continued the program by illustrating how grinding wheels made with man-made diamonds outperformed and outwore wheels made with the real things. Although there are still some applications where the latter type grinding wheels are more advantageous, Parke revealed that intensive research to improve the man-made diamonds in connection with grinding wheels is being carried on by both GE and Norton.
*—Richard I. Edwards*




*"Those Russians think they're so smart—wait till they see this entry in* THE TOOL ENGINEER *Gadgets Contest!"*

## *Last Call for Gadgeteers!*

Some people call them contrivances, devices, mechanisms, things.

Other people call them thingumabobs or -adoodles or -ajigs; or doodads, whatsits, jiggers, dinguses, gizmos, dojiggers, doohickeys, hootnannies. The French call them *je ne sais quoi.*

Tool engineers call them Gadgets.

Have you got any on your chest, or around your tool chest? If so, you have just one month left (until Dec. 31, 1959) to prepare them for entry in THE TOOL ENGINEER'S Gadgets Contest. The competition began Oct. 1 and is open to all members of ASTE.

Prizes (think of those Christmas bills!) will include $100 for first place, two $50 second prizes, four $25 third prizes, and honorable mention awards which will be a choice of the newly revised Tool Engineers Handbook or the Die Design Handbook. The National Editorial Committee will be judges.

Details and contest rules can be found elsewhere in this issue.

## Facts on Forging Revealed at Canton

CANTON—Fifty-five members of Chapter 110 heard how rigid metallurgical control of ingots and a well-planned tool engineering program can team up to produce units that can be forged on a series of huge drop hammers in the same heat.

William Smith, sales engineer for Ladish Co. of Cudahy, Wis., revealed this and other facts about forging at the October meeting. In his description of his firm's various projects, Smith told how the Ladish metallurgical department solved the problems of producing irregularly shaped forgings. A color film depicting the forge shops in full operation clarified many of the points in his speech for the ASTE audience.
*—Clifford Smith, Jr.*

## St. Louis

"Suppliers Night" was the feature of the October meeting, where 38 exhibitors displayed the latest developments in materials and equipment for tooling.

## Missile Expert Assures Members of American Military Might

CHICAGO—An answer to the most popular question in the United States today was given at the September meeting of Chapter 5. The question—"Can we duplicate the Russian moon shot?"—was asked of Col. Carlo Tosti, special assistant to the commander of air research and development command at Andrews Air Force Base.

The jet propulsion and guided missile expert, who graduated from Virginia Military Institute and received his master's degree in engineering administration from Stanford University, said that the United States has the "capability" of such a shot, but that the Government has thus far channeled the defense budget into more practical scientific areas that will "pay dividends in the long run."

Tosti, by means of slides and movies, depicted some of the pioneering successes and failures in the development of space missiles and vehicles. In pointing out the reasons for experimental failures, he told of the need for trained tool engineers and men versed in the "how-to-do-it" end of manufacturing. The speaker said that scientists, researchers and design experts work out the theories in the development of missiles, but that well-trained, imaginative tool engineers and manufacturing specialists must follow close behind to see that these theories are put into practice.

Col. Tosti's appearance at the Chicago meeting was arranged by Chapter Program Chairman Roy Bates.

*—Edward Schnell*

GREATER NEW YORK—By means of a number of demonstrations, Thornton W. Whipple (left), vice president of sales at E. H. Titchener & Co., proved to the 85 Chapter 34 members at the October meeting how time and money can be saved through the use of wire construction in product design. Whipple is seen here with Dominick Scolaro, chapter vice chairman.

*—Alfred M. Sampter*

DETROIT—John F. Morris, manager of Burgmaster Sales Div. of Burg Tool Mfg. Co., provided a demonstration of one feature of his talk on taped control drilling on small-lot production runs for some members of Chapter 1. Watching Morris, who spoke at the October meeting, are (left to right) Lloyd Hawley, Ed Till, Gil White, Gene Makie, and Joe Wrobel.

*—C. Francis Wrobel*

## Cold Extrusion Is Topic For Tri-Chapter Session

ITHACA—Cold extrusion and other metalworking operations were covered in a talk at the October meeting by W. S. Wagner, development engineer at the E. W. Bliss Co. One hundred members and guests from the Elmira, Binghamton and Harrisburg ASTE chapters were on hand.

The extrusion method of shaping metal consists of forcing the material by direct compression into the desired shape, Wagner said. He explained the factors involved in shaping metals. The working pressure required on the projected area of the job and the compressive resistance of the metal vary with the amount of flow and freedom, as well as with the material and amount of cold working to which the metal is subjected. As metal is pulled or squeezed into different shapes and press operations it grows harder and less ductile, Wagner warned. If the pulling is continued the stress will exceed the ultimate strength of the material and result in cracking or tearing. Wagner supplemented his talk with detailed charts.

A description of the five-million-pound radio telescope now being built by E. W. Bliss was also given by the speaker. The 140-foot parabolic disk will pivot on a 22-foot-diameter bearing. The bearing will be machined in the field to within 0.005 inch of perfect sphericity. In order to insure watch-like smoothness and accuracy, the telescope's moving parts will float on a film of oil 0.005 inch thick. When completed it will be one of the world's largest precision instruments.

*—Anna B. Gage*

## Student Chapter 28 Joins Society

GASTON TECH—Twenty engineering students were inducted into the Society the night of Oct. 30 when National Director Frank Ford conducted the chartering meeting at which the Gaston Technical Institute was officially recognized by ASTE. The main speaker at the affair was Sidney B. Jeffreys, past chairman of the Piedmont chapter which sponsored the student group. Taking over the duties of faculty adviser to the Gaston Tech chapter will be Robert M. Michael, head of the mechanical and production technology department at the school.

The institute, located in Gastonia, N. C., is operated under the auspices of the school of engineering by the college extension division of North Carolina State College.

SANTA CLARA VALLEY—Seventy-five members heard Ernest J. Stecker (center), president of the Holex Corp., Hollister, Calif., describe a new tool being used by industry today—explosive forming. Pictured with the speaker at the September meeting are Paul Davenport (left), program chairman, and William Forbes, chairman of Chapter 98.—*W. C. Lanyon*

UNIVERSITY OF KANSAS—A demonstration of metallizing, using the latest equipment donated by Metallizing Engineering Co. of U. of K's school of engineering, is given by Larry Powell, field engineer for that firm. Powell spoke at the October meeting before an audience of 63 student members and guests. *—Charles M. Bradley*

## Diamond Developments Described at Peoria

PEORIA—"Man-Made Diamonds," their history and application, were described at Chapter 31's October meeting. Two experts on the subject—John T. Elovich, manager of diamond sales at the General Electric Co., and John W. Ripple, manager of diamond products at The Carborundum Co.—spoke to the 145 members in attendance.

Elovich traced the origin of natural diamonds and the early development of man-made diamonds. He described the temperatures and pressures used to form diamonds. Ripple cited facts from grind tests using diamonds made by GE. He also told where diamonds should be used and which applications should be confined to conventional grinding grit.

—Vince Ekiss

## Plant Tour Attracts Denver Membership

DENVER—A tour through the General Iron Works plant highlighted the September meeting of Chapter 77. Sixty members participated in the tour of the facilities of this firm which manufactures large mining, water filtration and pressure vessel equipment for five engineering companies. General Iron Works guides conducted the group through every department in the plant.

A firm which employs many members of the Denver chapter was accepted as an affiliate member at this same meeting. Membership Chairman Martin Sheridan presented an affiliate membership plaque to Chester Phillips, official representative of the Martin-Denver Co., makers of the Titan intercontinental ballistic missile.

MID-PENNSYLVANIA—Charter in hand, Chairman Richard F. Wescoe and the officers of the newly formed Chapter 161 pose following their installation by ASTE President Wayne Ewing at the chartering ceremony Sept. 28. The officers (left to right) are: Raymond Wells, treasurer; Robert Rhoads, Sr., secretary; Wescoe; George Norton, Jr., second vice chairman; and Howard L. Faust, first vice chairman. With this chartering, 80 members were added to the Society. *—Raymond C. Wilson*

## Abrasives Expert Offers Tips on Grinding Wheels

MONADNOCK—A specialist in abrasives, Richard C. DeLong of the Bay State Abrasive Products Co. in Westboro, Mass., was the technical speaker at the monthly meeting. His talk on tolerances in grinding wheel manufacture was directed primarily toward the consumer's requirements in this area. He emphasized the need for careful consideration of unusual tolerance when ordering grinding wheels.

Many times, DeLong stated, standard wheels can be used or altered to give the same or better results than wheels previously made to some unusual specifications. When grinding problems arise, a specialist in the abrasive line should be consulted because of his varied background in the application of products.

DeLong concluded his talk with a movie illustrating the manufacture of abrasives by his firm. *—Paul E. Tilton*

KNOXVILLE-OAK RIDGE—Harry Conn, chief engineer at Scully-Jones & Co., presented a talk on "Optimation" at the October meeting. His talk covered the machining concept that enables the manufacturer to obtain higher production at a lower unit cost. This results from applying economics, metal-cutting research and advanced tool engineering to computation of speeds, feeds, tool changes, tool grinding, and tool depreciation. *—J. W. Coleman, Jr.*

## Past Chairman Dies

FORT WAYNE—A member of the ASTE since 1943, first as a member-at-large and then as a charter member of the Fort Wayne chapter, Milton H. Kline died recently. He was the secretary of Chapter 56 in 1944 and took over the chairmanship in 1945. A sales engineer, Kline worked for the General Electric Co. in Fort Wayne.

## SPECIAL EVENTS

| | | |
|---|---|---|
| ASTE Seminar—"Metal Forming Methods for Tomorrow's Manufacturing" | Dec. 3-4 | LaSalle Hotel, Chicago, Ill. |
| ASTE Seminar—"Numerical Control in Creative Manufacturing" | Dec. 10 | Bond Hotel, Hartford, Conn. |
| ASTE Seminar—"Optical Tooling Methods in Manufacturing" | Jan. 12, '60 | Sheraton Hotel, Philadelphia, Pa. |
| ASTE Seminar—"Numerical Control" | Jan. 26, '60 | Ambassador Hotel, Los Angeles, Calif. |
| ASTE Seminar—"What We Know Today about Metal Cutting" | Jan. 28-29, '60 | Sheraton-Palace Hotel, San Francisco, Calif. |
| On-Campus Conference | Feb. 13, '60 | University of Colorado, Boulder, Colo. |
| Second Annual Production Institute | Mar. 21-22, '60 | University of Wichita, Wichita, Kan. |
| ASTE 28th Annual Meeting | Apr. 21-28, '60 | Statler-Hilton and Sheraton-Cadillac Hotels Detroit, Mich. |
| ASTE Tool Show | Apr. 21-28, '60 | Detroit Artillery Armory Detroit, Mich. |

## Personnel Changes At Headquarters

Formerly staff administrator for education and professional development and membership supervisor, Tony Downey has been appointed assistant exposition manager.

Glen Underwood has taken over the job of manager of the membership data processing department when what had at one time been two separate general office activities were combined. Most recently a sales agent for Mutual of Omaha, Underwood was also circulation manager for *Production* magazine for six years, and manager of the tabulating department at Detrex Corp. Originally from Chattanooga, Tenn., he has resided in the Detroit area for the past 15 years.

An addition has been made to the public relations staff. Gary Woditsch has joined ASTE from the Fra-Wood Co. of Hazel Park, Mich., where he worked at various jobs including product designing and advertising copywriting. During this same two-year period he also taught philosophy at the University of Detroit, from which he was graduated in 1957 with a bachelor of philosophy degree.

Eric C. Anderson-Smith recently joined the Headquarters staff as advertising services supervisor. Three Detroit advertising agencies claimed his services before he came to ASTE—Michael Glick Advertising, Anderson-Smith Advertising (his own firm), and Ross Roy Inc. Anderson-Smith received his education at Kansas State University.

## Fall Meeting Features Airplanes of Future

WICHITA—Chapter 25 inaugurated the fall chapter meeting season with an Oct. 15 session at the new campus activities center at the University of Wichita. Forty members were on hand to hear R. T. Hook of Warner & Swasey Co. describe the research advancements being made with respect to the theme of his talk—"Sixty Percent of New Airplanes Will Be Steel."

Hook told of the advantages and disadvantages of high-speed steels, carbides and ceramics as means not only to accomplishing machining operations, but as means to accomplishing them economically. Something to look forward to, he said, will be the new 80 percent titanium, nickel, molybdenum carbides being developed by Ford Motor Co.

Things that must follow the improvement trend in order to produce 80 percent steel airplanes by 1967 are: higher cutting speeds, machinability, precision forgings with a minimum of metal to be removed, and handling times. If handling methods are not improved at the rate of new developments in cutting technology, time expended in handling will be greater than cutting time, the speaker concluded.

Chapter 52 is also continuing with their plans for the annual Production Institute to be held at the University of Wichita on March 21 and 22 of 1960. The theme of this two-day session will be "Producibility—a Key to Cost Reduction." —*Frank K. Dickerson*


### *Positions Available*

**METAL FINISHING SPECIALIST**—Young college graduate, chemist or engineer preferred. Wanted for developing and promoting of processing oils and lubricants to be marketed to metalworking industries. Position offers unusually attractive growth potential with nationally recognized Eastern United States oil refiner expanding into new field of activity. State full background, education, experience, and salary requirements. Write to Classified Ads, Dept. 164, 10700 Puritan Ave., Detroit 38, Mich.

**MECHANICAL ENGINEER**—Leading manufacturer of laminated plastics, located in eastern Pennsylvania, has excellent opportunity for graduate M. E. with design experience in product and manufacturing methods. Knowledge of related tool design and toolmaking desirable. Must have initiative, leadership, and ability to keep abreast of modern developments. Working and living conditions are first rate. Give all details of education and experience in first letter. Write to Classified Ads, Dept. 167, 10700 Puritan Ave., Detroit 38, Mich.

### *Position Wanted*

**INDUSTRIAL MANAGEMENT**—Position desired by college graduate who has earned degrees in business administration and associate mechanical engineering. Age 28. Practical experience includes four years of apprenticeship and four years as journeyman sheet metal technician. Write to Classified Ads, Dept. 166, 10700 Puritan Ave., Detroit 38, Mich.


## Meeting and Tour Fill Ontario Chapter's Schedule

GRAND RIVER VALLEY—The Oct. 2 meeting of Chapter 81 was given over to a talk by Don Fields, field representative for SKF Industries, Inc. His topic, illustrated by a motion picture and slides, was "Bearing Manufacture and Application."

A tour of the P. L. Robertson Mfg. Co., Ltd., Milton, Ont., was conducted by this chapter on Oct. 22. The Canadian firm manufacturers such things as tapping screws, nuts and bolts. The two-hour tour was set up by Wilbert Karges, chapter program chairman.

At their December meeting the Grand River Valley chapter plans to feature J. A. Brown, professional engineer and partner of Woods, Gordon & Co., speaking on "Material Handling in Metalworking Plants." The Canadian Welding Society and Engineering Institute of Canada will join the ASTE chapter in sponsoring this event.

—*Hermann Rochau*

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The company that first developed carbides for machining steel . . . the company that introduced throw-away inserts . . . now announces another first . . . putting the "premium" on quality instead of price. V-R has eliminated all price differentials between carbide grades . . . simplifying carbide pricing and making it easier for you to order, stock and use V-R carbide.

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# Progress in Production

## MILLING "UNMACHINABLE" MATERIALS

Developed by Boeing Airplane Co. manufacturing research engineers, a milling process for trimming Armco PH

**Spray of carbon dioxide coolant envelopes workpiece and cutter as nickel-base alloy is machined.**

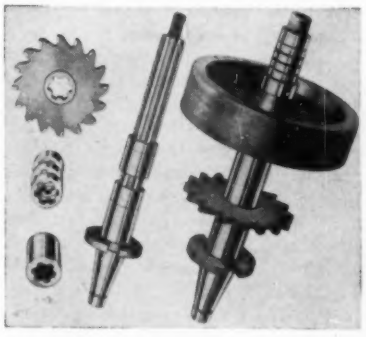
15-7 Mo stainless steel alloy has potential applications for machining ultra-hard metals. The process could conceivably save millions of dollars throughout the defense industry. The technique combines the high speeds of routing with the mechanical feeds, cutting pressures and solid fixturing of standard milling practice, plus climb cutting, carbide-brazed cutting tools and liquid carbon dioxide cooling on both cutter and point of machining.

A standard knee-milling unit equipped with a high-speed routing head is used. Cutter speeds as high as 7000 rpm and feed rates up to 180 ipm have been achieved. As much as 60 lineal feet of annealed 0.125 in. PH 15-7 Mo, with tensile strength of 130,000 psi have been test trimmed in a matter of minutes before tool failure.

The new process is expected to increase production rates a hundred fold, with similar significant increases in tool life. New areas of application in machining the "unmachinable" new steels, nickel-base and cobalt alloys and other metals designed to withstand the high temperatures of hypersonic flight will be explored. Tests in the immediate future will determine maximum and minimum thickness that can be milled and how deep a cut may be taken. PH 15-7 Mo sheets, heat treated to tensile strengths up to 220,000 psi, are being evaluated. Both numerically controlled and hydraulically controlled profile mills may be adapted to use the new process.

## SPLINED ASSEMBLY MILLS HARDENED STEEL

Radical improvement in heavy-duty milling performance, particularly in machining high-strength alloys in the hardened state, is being obtained with



**Splined arbor and cutters used for milling hardened steel.**

splined milling arbors and cutters developed by Pratt & Whitney Co., Inc. Metal removal rates are increased by 92 to 400 percent with cutter life increased proportionately. In actual milling operations on 5415 steel, 225-260 Bhn, stock was removed at a rate of nearly 50 cu. in. per minute.

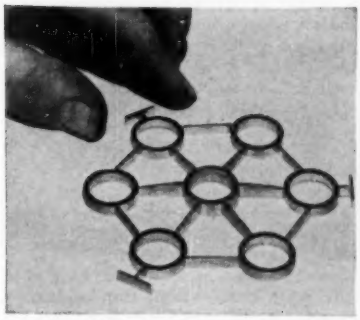
In this construction, both arbors and spacers are splined. Resulting resistance to torsional deflection of the assembly is greater than that of conventional arbors of the same size. Added resistance to torsional deflection greatly reduces backlash, the principal source of inefficiency when milling hardened alloys. With backlash reduced, increased cutting speeds are possible and chatter is minimized.

Modern demands for increased precision have led to a rapid increase in the practice of machining high-strength alloys after hardening to avoid loss of dimensional accuracy through heat treating. Since these alloys often run from 55 to 65 $R_C$, past machining practice has often been difficult and costly.

## REDESIGN CUTS BRAZING COST

Redesign to utilize brazing resulted in a 70 percent reduction in manufacturing and material costs in the case of a stainless steel fuel cluster rod separator in an atomic reactor.

Originally designed as a complex form machined from Type 302 stainless steel, the separator was costly due to the time-consuming machining operations involved. It was redesigned by Stainless Processing Div. of Wall Colmonoy



**Furnace-brazed fuel-cluster rod separator for an atomic reactor. Brazing effects savings in labor and time.**

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**For every job requirement.** Stocked in fifteen different styles, new Kennametal End Mills are available in diameters from 1/16" to 3/4" . . . a size and style to match your milling requirements.

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New 12-page Catalog now available. Ask your Kennametal Representative or write Kennametal Inc., Latrobe, Pa.

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USE READER SERVICE CARD, CIRCLE 28

## Progress in Production

Corp., Detroit, as a brazed assembly. A prototype of the brazed part, made up of 25 sin.ple stampings and screw machine parts, is shown in the accompanying photo.

The 25 pieces are simultaneously brazed in a pure dry hydrogen furnace at 2150 F using Nicrobraz brazing alloy, a nickel base stainless type material especially suited to high-temperature service.

### GIANT FIXTURE AIDS PLASTICS CURING

Designed for missile industry use, a rotating fixture built by Raven Engineering of Los Angeles will be used for oven-curing plastic coatings on large diameter missile motors and components. The fixture handles cylindrical parts in sizes to 150 in. diam, 36 ft in length and weighing 60,000 lb. The workpiece is gripped and turned by a four-jaw chuck at infinitely variable speeds from 0 to 150 rpm.

The fixture is stressed for 8 g when turning parts of maximum size. Outer rim of the chuck is ground to within ± 0.0005 in. of true concentricity, and is supported during turning by the large rollers mounted on each side. At the tailstock two similar rollers support the workpiece and two rollers at the top stabilize it during rotation. The bottom set of tailstock rollers can be adjusted laterally as well as relative to each other, which allows leveling of the cylindrical workpiece within ± 0.020 in., as well as adjustment for up to 3 in. misalignment. The chuck is dynamically balanced by counter-opposed and adjustable fixed weights. A drive motor provides a highly stable rate of turning over the full range of speeds. Controls provide for automatic detection and shut-off in event of excessive vibration.

All bearings are monitored to detect overheating. Because the system must operate in temperatures up to 180 F for extended periods of time, it has been designed with water-cooled forced-oil lubrication. The fixture is now being installed in one of the West Coast plants of Aerojet-General Corp.

**Fixture partially assembled. Top stabilizing rollers and chuck not shown.**

### CAST FITTINGS SOLVE CORROSION PROBLEM

Operating in a corrosive environment, cast stainless header bodies are giving trouble-free service and have solved replacement problems in producing high-octane gasoline at the El Segundo plant of the Standard Oil Co. of California. Serving as return bends to control the direction of oil flow through the furnace, these fittings combine the corrosion resistance of stainless alloys with the design advantages of casting process.

Oils processed in this plant are usually California crudes, which contain sulfur and other elements that cause carbon steel to corrode rapidly. Corrosion is intensified by the high pressure and temperature at which these fluids are handled—450 psi and 900 F. To resist this combination of conditions, the header bodies were cast of type CF-8 (Alloy Casting Institute designation) stainless alloy. ACI type CF-8 casting alloy contains 18-21 percent chromium, 8-11 percent nickel and a maximum of 0.08 percent carbon.

**Integrally cast fitting for use in refining crude oil at high temperature and pressures.**

Evaluation of the factors involved in producing complex shapes from cast and wrought materials points up the suitability of the casting process for

parts such as these header bodies. Fabrication of a header body from wrought materials requires a multiple-piece welded assembly. In austenitic alloys, welding causes precipitation of carbides along grain boundaries in the heat-affected zone, especially when fairly thick sections and prolonged welding time are involved. Post-weld annealing operations are required to restore carbides into solution. This susceptibility of welded seams to intergranular corrosion introduces a possibility of mechanical failure and oil leakage.

By contrast, the integrally cast header body represents a more satisfactory and more economical design, since welding is avoided and machining requirements reduced. Another advantage of the single-piece cast body is good resistance to severe mechanical shock, a frequent cause of leakage in welded joints. Generous fillets and radii provided by cast design eliminate crevices, prevent the entrapment of contaminants.

## COOLANT CLARIFIER IMPROVES FILTRATION

First installation in the United States of a new high-capacity centrifugal coolant clarifier called the "Turbomatic" has resulted in a 39 percent increase in clarification and lowered operation and maintenance costs for Avco Corp's Lycoming Div. Lycoming uses the clarifier at its Stratford, Conn. plant to purify coolant used in the grinding of turbine blades for jet engines. The blades are made from Type 403 (nonmagnetic) stainless steel and require a first-class finish with tolerances held to 0.0005 in.

Machine tools coupled to the Turbomatic are model 85 Excello grinders having a nominal coolant flow of 40 gpm. Metal removal by grinding is between 0.030 in. to 0.96 in. with a maximum 0.002 in. on the roughing pass. It was found that abrasive material remaining in recirculated coolant even after filtering caused scratching. Tests showed filters were removing only 60 per cent of the filterable material. Particles of less than three microns in size could not be filtered.

Centrifugal force is fully utilized in the Turbomatic by means of conical disks which divide the liquid into many thin layers. Extracted solids are purged twice per shift from a high-capacity bowl. This is done by a reversing current switch that brakes the machine to a full stop in eight to ten seconds. Rapid braking action coupled with the bowl's 45 deg operating angle causes accumulated sludge to fall into a sump provided at the bottom of the machine.


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FRINGECOUNT*
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*Millionth accuracy . . . absolute measurement . . . convenient to use*

The new FRINGECOUNT micrometer opens up a whole new dimension in gaging. With this unique instrument, industrial organizations can now make absolute dimensional measurements to an accuracy of one-millionth of an inch under properly controlled conditions. Simple to operate, the FRINGECOUNT can be mastered quickly by industrial gage personnel . . . does not require trained physicists for effective results.

The FRINGECOUNT determines the true size of parts by reference to the wavelength of light, thereby eliminating the need for man-made secondary references. In a recent series of tests, Bureau of Standards calibrated gage blocks were measured at six different laboratories using six different FRINGECOUNTS. The result: all of the blocks were within the Bureau's tolerance of ±2 millionths of an inch! It is this consistent performance that is rapidly establishing the FRINGECOUNT micrometer as the ultimate in precision gaging instruments.

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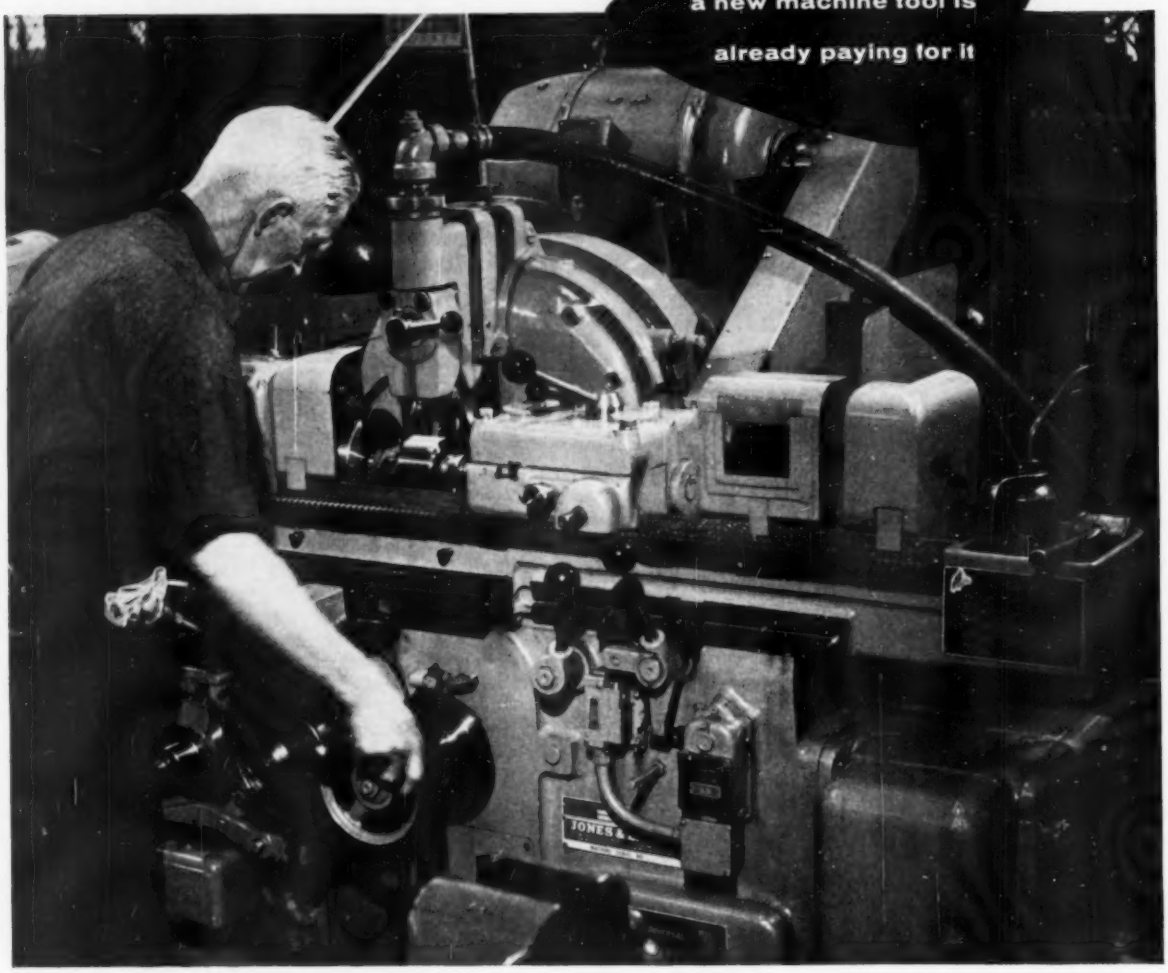
# JONES & LAMSON MACHINE TOOLS

the man who needs a new machine tool is already paying for it



## Close Tolerance Tool Room Work on an Automatic machine with Universal Application

A customer writes: "The versatility of Jones & Lamson Thread Grinders is scarcely tested in the conventional production of hobs, taps, gages and threaded parts. In our toolroom, using the thread grinder as a basis for 'Rube Goldberg' development, we have produced precision racks, small form-profiled milling cutters, oil grooves and grinding wheel crushers.

"While serving the purpose as a necessary piece of equipment, this machine also provides a means by which many additional production problems can be explored and tested. Applying the thread grinder to toolroom problems is putting the best foot forward for quickly producing accurate and dependable shop accessories."

* * *

Write for catalog 600. Jones & Lamson Machine Company, 518 Clinton Street, Springfield, Vermont.

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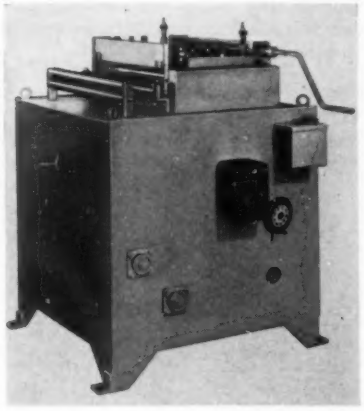
# TOOLS of today

## Stock Feeding, Straightening Machine

Combining the features of a roll straightener with those of an automatic feeding machine, this unit is available with either one or two electromagnetic drive clutches controlled by an adjustable feed length measuring timer. The machine is capable of feeding uniform, controlled lengths of coiled, flat or strip stock, simultaneously passing them through a series of powered rolls, and producing flat stock free of curl or camber.



On standard models the timer can be set to produce any length up to 60 in. By adding a timer bypass circuit, work of any length can be fed. Two styles provide either a variable speed drive or fixed rate feed. A variety of sizes is available to accommodate stock up to 50 in. wide and in various gages.

Benchmaster Mfg. Co., Gardena, Calif. **Circle 350**

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## Parts Orienter

Available with or without demand-feed control, this orienting belt elevator with variable speed drive will handle a wide range of rolling or sliding parts. A motor driven steel chain belt with steel cleats carries parts up to the discharge chute into which they roll or slide, completely or partially

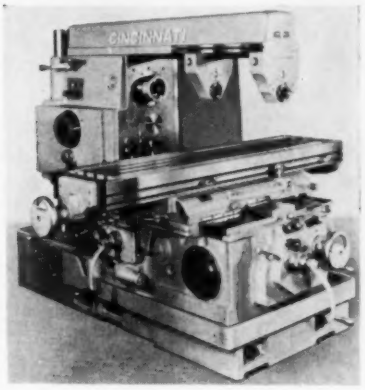
oriented, depending on the shape of the part. Further orientation can be obtained by attaching special tracking devices to the discharge chute.

The unit can be used to feed rotary and vibratory hoppers or to feed parts directly into production and assembly machines.

Radio Corporation of America, Industrial and Automation Div., 12605 Arnold Ave., Detroit 39, Mich. **Circle 351**

## Fixed Knee Mill

Rigidity of a bed type, convenience of a knee and column type and capacity of a rise-and-fall type are combined in this fixed knee milling machine. Saddle and table are mounted directly on the machine bed, eliminating the knee, and vertical motion is transfered to the spindle carrier.




The machine is suited to heavy cuts, climb and conventional milling, and large, heavy workpieces. Front and side controls are provided for operator convenience. There are 32 feed rates and 24 speed rates, both in geometric progression. Manual or automatic cycling of the table is operator controlled.

The machine is available in four models ranging from 20 to 30 hp, with 72 to 80-in. table travel, 12-in. saddle travel and 20-in. vertical travel.

Cincinnati Milling Machine Co., 4701 Marburg Ave., Cincinnati 9, Ohio. **Circle 352**

## Cutting, Deburring Tool

Cutting and deburring of sheet stock and extruded parts are combined in this tool, which reduces by 75 percent

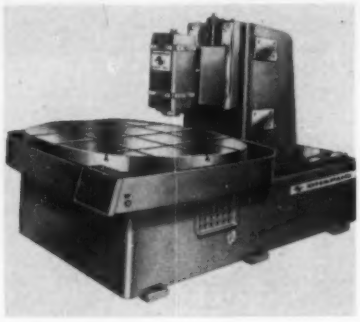
the time required for deburring and speeds up the cutting process. It is designed for use with aluminum sheets and extrusions measuring from about 1/32 to 1/4 in.

Aircraft Tools, Inc., Los Angeles, Calif. **Circle 353**

## Rotary Table Milling Machine

The MM-48 Mach-Mil is a rotary table machine for nonferrous face milling. The unit is supplied with attachments for secondary operations, providing a combination of high milling speeds and fast rotary table speeds with rigidity in over-all construction equal to that of bed type machines.

The basic machine is designed with a single vertical head for face milling.



A second milling head may be supplied as extra equipment to make possible, in a single pass, such double operations as roughing and finishing, face milling and profiling or milling at two elevations.

The table has a work surface diameter of 48 in. The face milling head is adjustable vertically in a range from 2 to 15 in. The adjustable column position provides a radial adjustment of the milling head relative to the table ranging from 12 to 28 in. The rotary table drive provides a variable peripheral feed rate of 18½ to 120 ipm. Optional table drive rate is from 37 to 300 ipm.

Onsrud Machine Works, Inc., 7726 Lehigh Ave., Niles 48, Ill. **Circle 354**

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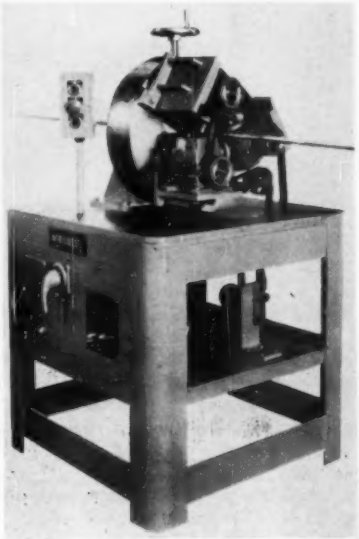
## Tube Marking Machine

Continuous marking of manufacturer's identity or other information is done by Model 534, applying identical EMT markings permanently at one-ft intervals along lengths of tubing in sizes from 3/8 to 2-in. OD. It also marks at three radial locations, 120 deg apart.

Feed rate is variable from 175 to 350 fpm. Jaws of the 18-in. scroll chuck are modified to hold three roll die heads, each of which accommodates a concave roll marking die. Dies are adjusted for various tube diameters by movement of the chuck jaws. An idler spindle and pulley automatically pick up belt slack caused by movement of the heads.



The machine is equipped with a variable speed drive with jog, start and emergency stop buttons.

Noble & Westbrook Mfg. Co., Westbrook St., East Hartford, Conn. **Circle 355**

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GUARANTEED TO MATCH OR EXCEED, "CRITICAL" JOB SPECIFICATIONS
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PRECISION FITTED BEARINGS
Ideal Live Centers feature precision machined and hardened ball and/or roller bearings for superior accuracy and performance. Sealed to keep dirt out, grease in.

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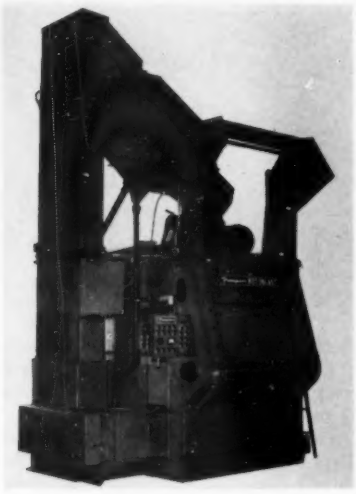
## Blast Cleaning Barrel

Castings weighing up to 500 lb each, or a batch load of 2700 lb, can be handled by this 15-cu ft medium-size

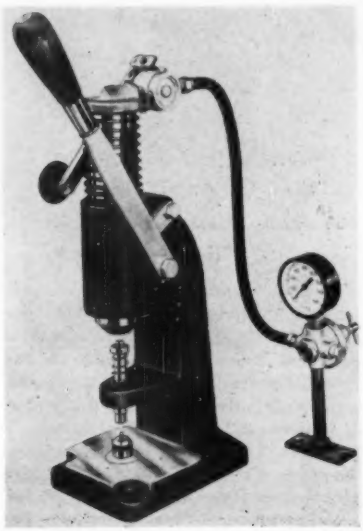


heavy duty cleaning barrel. The Roto-blast is available with standard controls or in semi or completely automated types. The unit is powered by a 30-hp wheel which delivers 50,000 lb of abrasive per hour.

Pangborn Corp., Hagerstown, Md. **Circle 356**

## Arbor, Stamping Press

Basically an arbor press with a staking feature, the Air Staker performs pressing or staking operations independently or combines them in rapid sequence. Fit of tools is within 0.001 in. and the platen is machined square to the work line, providing die-set accuracy.



Staking is accomplished by the impact of a tool steel piston rod inside the arbor press ram, which serves as an air cylinder. Because air pressure is vented before impact, every blow is identical, producing uniform assemblies.

Force of the staking blow is adjustable by a pressure regulator on the air valve, from 15 psi to line pressure.

Cramer Controls Corp., Centerbrook, Conn. **Circle 357**

## Miniature Precision Differential

Available in ball and oilless bearing units, V15 type differentials are certified to MIL specifications. Shaft sizes are 5/64, 3/32 and 1/8 in. A variety of stainless steel and aluminum end gears

are available in 96, 120 and 200 pitches with teeth ranging from 100 to 600.

Static friction under load is not more than five percent. Load rating is 10 oz-in. Maximum recommended operation speed is 1000 rpm for ball bearing units.

PIC Design Corp., 477 Atlantic Ave., East Rockaway, L. I., N. Y. **Circle 358**

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379-B

**CIRCLE R** Carbide and Carbide Tipped Saws increase production manifold on tough jobs — and keep up the pace because *they retain their tips,* due to superior tipping-in. And exclusive Circle R Heat Treating perfects them for your purposes. Ask your Circle R Specialist.

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INDIANAPOLIS — Walter F. Greene & Assn.
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PHOENIX — DiEugenio Tool Center
PITTSBURGH — Dolph Esposito & Company
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ST. LOUIS — R. C. MacDonald & Co.
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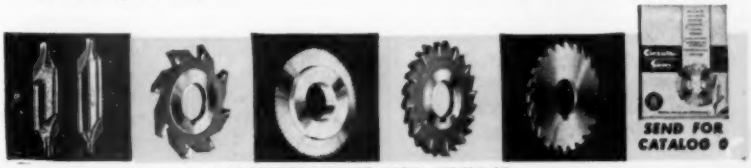


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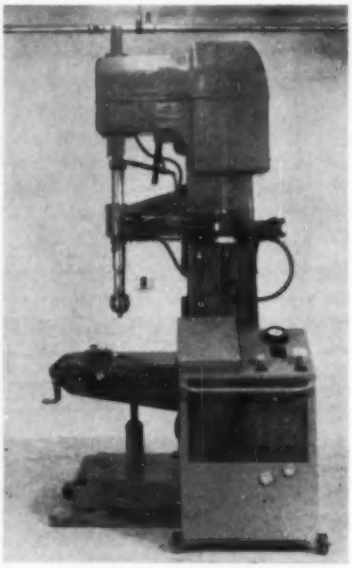
USE READER SERVICE CARD, CIRCLE 33



## Drill Press Feeds

Self-contained hydraulic feeds for heavy-duty drill presses have capacities up to approximately 1½ in. in steel. The units consist of a heavy-duty power transmission arm and a console that houses the control valves and hydraulic tank and pump.



The valve control system provides a variable and quickly adjustable approach speed, slowdown for work entry, return speed and working thrust. Precision switches and fast reaction of the valves provide reliable depth control.

Beckett-Harcum Co., 985 W. Locust St., Wilmington, Ohio. **Circle 359**

USE READER SERVICE CARD ON PAGE 131 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

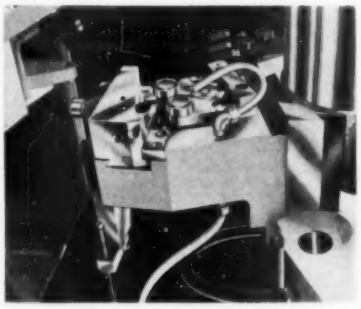
## Plastic Repair Material

Industrial repair jobs can be handled with an epoxy-polyamide chemical compound which is permanently effective with materials ranging from concrete and metals to cloth, paper and most plastics. The all-purpose general repair compound, chemically noncritical in use, is supplied in kits consisting of one can of white base and one of black hardener. Equal parts of the epoxy resin base are mixed with the polyamide hardener with a trowel or spatula to a neutral gray composition. The mix can be formed to a fine edge and, in cured form, can be sanded, drilled and machined to a smooth surface.

Plastic-Mastic, Williamson Adhesives, Inc., 8220 Kimball Ave., Skokie, Ill. **Circle 360**

## Bar Turner

Retractable-cutter bar turner is designed for use with the W&S 2AB single-spindle bar automatics. The unit



provides efficient metal removal with close tolerances and smooth, burnished work surfaces. It will handle bars from ½ to 2¾ in. diam.

The Warner & Swasey Co., Cleveland 3, Ohio. **Circle 361**

## Microhardness Tester

Testing of cutting tools, carbide tips, instrument pivots, electroplated surfaces, sheet metal, plastics and other materials can be expedited with the Model LL Tukon semiautomatic microhardness tester. Indention loads range from 25 to 1000 grams and vertical capacity is 2½ in.

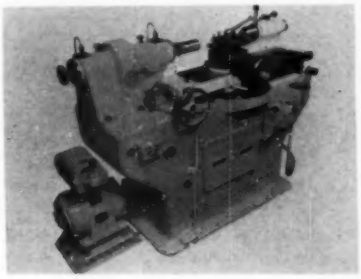
The instrument is equipped with a Bausch & Lomb microscope with calibrated 40X par-focalled dry objective for rapid measurement of the length of hardness indentation directly in microns. The model uses both the Knoop and 136-deg diamond pyramid indenter. It is powered by 110-v, 60-cycle a-c.

Wilson Mechanical Instrument Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport 2, Conn. **Circle 362**

## Finishing Lathe

Utilizing diamond, ceramic or carbide tools, this lathe produces turned surfaces with finishes and accuracies of from three to five micro-inches. It is used especially for turning nonferrous machine components, eliminating extra operations such as lapping and honing.

Specifications include a capacity of eight in; 17½-in. distance between centers; a 4¾-in. center height above slide; and a slide movement of 10 in.



Feeds are 0.001 to 0.005 ipr. Spindle speeds range from 705 to 2920 rpm.

Milo Mfg. Co., 464 North Broad St., Elizabeth, N. J. **Circle 363**

USE READER SERVICE CARD ON PAGE 131 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Power Drill Screwdriver

All kinds of bits, including twist drills up to ⅜ in., wood augers to ¾ in., masonry bits up to ½ in. and hole saws from ⅝ to 1¾ in., can be used with the power unit. A double-

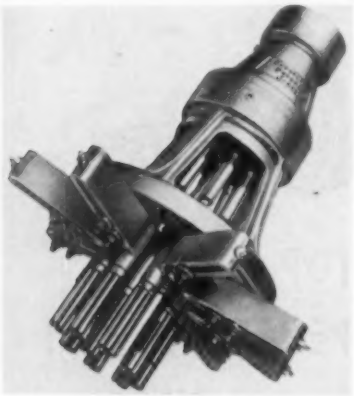
purpose tool, useable as either a drill or screwdriver, it can also be used for running up nuts by using shanks and sockets. A reversing switch permits quick removal of screw or nuts.

The Black & Decker Mfg. Co., Towson 4, Md. **Circle 364**

USE READER SERVICE CARD. CIRCLE 34

## Multispindle Drill Head

Model 98-X, the Hercules, is a heavy-duty, multiple spindle drill head with nine driving stubs (one is a center stub) and a maximum capacity of nine $\frac{5}{8}$-in. drills in mild steel. Maximum center distance of spindles is $7\frac{3}{8}$ in.; minimum center distance is 1 in. When used for multiple hole tapping, the head has a capacity of nine $\frac{1}{2}$-in. taps in mild steel.



Plain Morse tapper, vertical adjustable and collet type spindle assemblies are available for the head. Locating plates, cluster plates, guide bar assemblies and additional accessories are also available.

The head has a 1:1 gear ratio and is recommended for speeds to 2500 rpm.

Cleveland Pneumatic Industries, Industrial Sales Div., 64 Old Orchard, Skokie, Ill. **Circle 365**

USE READER SERVICE CARD ON PAGE 131 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Hydraulic Press

Principal features of the Series S hydraulic multipresses, in capacities from three to eight tons, are a larger bed, more rigid frame, more knee room, and an easily accessible adjuster relief valve to give adjustment of ram pressure.

The units have a pushbutton gage valve for quick-pressure reading and longer gage life, a newly designed cylinder for faster operating speeds, and a quick-adjusting inch and stroke change control.

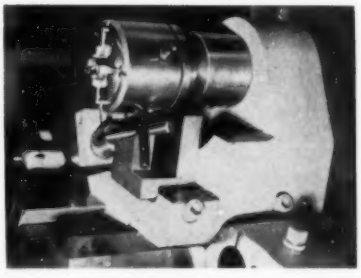
Built to JIC specifications, the multipresses are available with manual or automatic controls, and are designed for use with Denison 6 or 12-station indexing tables.

Denison Engineering Div., American Brake Shoe Co., 1160 Dublin Rd., Columbus 16, Ohio. **Circle 366**

## Die Head Reset Device

Capable of handling die heads up to a maximum diameter of $7\frac{1}{2}$ in., a hydraulic mechanism resets automatically during operation of 2AB single spindle bar automatics.

Powered by hydraulic oil supplied from the main reservoir of the 2AB through a special "spider" distributor (for both coolant and hydraulic oil) mounted on the back of the pentagon turret, the device operates automatically during the opening and closing of the machine's hydraulically actuated collet chuck. A closer cam moves forward to actuate the die head reset handle. A specially designed die head holder is used to accommodate the cylinder and cam.



The unit is designed to reset Landis, Geometric and National Acme die heads. The die head holder can be used for holding bar tools when the die head is not needed in a particular setup.

Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio. **Circle 367**

NEW ALINA DIAL COMPARATOR SET NO. 99

**The 3 purpose instrument with unlimited application in your inspection department**

Use as Dial Indicator graduated to read in .0001".

Use as Bore Gage covering a range of .200" thru 5.090" and reading in .0001".

Use as Dial Test Indicator graduated in .0005".

The No. 99 incorporates a high quality dial indicator together with all the necessary gage heads and extensions. It may be used directly at your machines or clamped to your fixtures. Furnished in handsome plush-lined case.

Dial Test Indicator Set No. 98, a modification of the No. 99, is especially designed for applications where measurements must be taken in deep holes, slots, etc. Write for detailed brochure.

WRITE FOR ILLUSTRATED LITERATURE.

ALINA CORPORATION

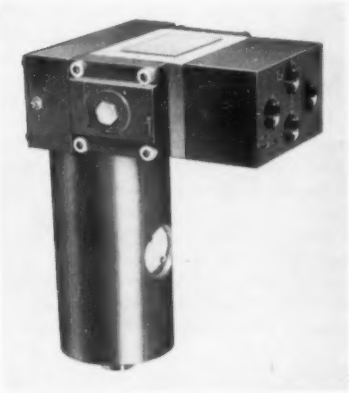
122 East Second Street, Mineola, Long Island, New York

Alina Corporation, 853 East 8 Mile Road, Detroit 20, Michigan

USE READER SERVICE CARD, CIRCLE 35

## Tracer Unit

Designed for tracer control of any type of machine tool, this hydraulic probe unit is equipped with a Pegasus hydraulic servo-valve. The unit is intended for single-axis tracing. The combined hysteresis and dead space is under 0.000050 in.



In each of two models, the probe is stable at operating pressures from 200 to 3000 psi. At 1000 psi, Model TC-320 has a capacity of 5 gpm with flow rate of 1 gpm per 0.001-in. stylus deflection. Model TC-340 operates at a capacity of 10 gpm with flow rate of 2 gpm per 0.001-in. stylus deflection. Operating temperatures range from 60 to 120 deg.

Electronic-hydraulic and hydraulic tracer controls are also available for controlling in two or three dimensions.

Tracer Control Co., 595 E. Ten Mile Rd., Hazel Park, Mich. **Circle 368**

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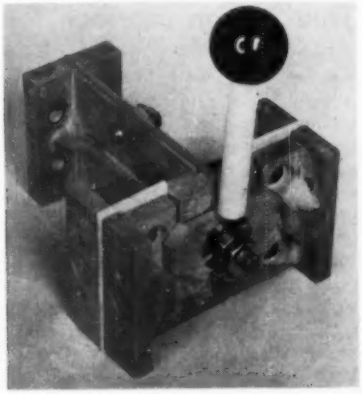
## Transfer Switch

A heavy-duty transfer switch will convert a single output induction heating generator into a dual-output system or a two-station system into a four-station system. Change-over time for tooling is eliminated since fixtures and coils may be left set up and ready for use.

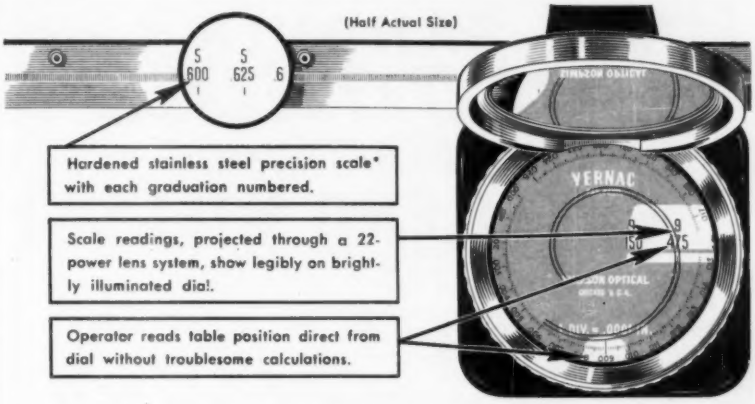


Induction Heating Corp., 181 Wythe Ave., Brooklyn 11, N. Y. **Circle 369**

## Insert Type Toolholder

Toolholder for disposable carbide inserts has a steel-cutting grade, carbide chipbreaker that is fully adjustable, provides positive settings, and is indexable with two working edges. Cutting pressure is taken on keys and major clamp screw. The negative rake Carboloy Adjust-O-Breaker is available in five styles, three different sizes, and in left and right-hand models.

Metallurgical Products Dept. General Electric Co., 11177 E. Eight Mile Rd., Detroit 32, Mich. **Circle 370**



(Half Actual Size)
Hardened stainless steel precision scale* with each graduation numbered.
Scale readings, projected through a 22-power lens system, show legibly on brightly illuminated dial.
Operator reads table position direct from dial without troublesome calculations.
VERNAC

**New optical measuring instrument assures . . .**

# high operating accuracy for new or used machine tools

The new VERNAC Direct Reading Optical Measuring Instrument eliminates the complexities of using end rods and gage blocks. Now, the longitudinal, lateral or vertical positioning of machine tool tables can be quickly and easily read direct to .0001". Accuracy is not affected by the wear or stretch of table movement screws. The instrument itself has no moving parts which can impair accuracy.

VERNAC instruments also up-grade machine tools to perform tasks beyond their original accuracy. For example, they can up-grade moderately priced milling machines to the accuracy of more expensive jig boring machines at a fraction of the latter's cost.

*The scale is a replica of a master certified by the U.S. National Bureau of Standards to .0001" maximum error over its entire length.

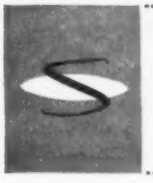
**SEND FOR FREE BULLETIN.** Explains how the VERNAC enables you to do more precise work on your present machine tools.

**VERNAC**® UNITED STATES AND FOREIGN PATENTS PENDING

*Designed and Manufactured by*
**SIMPSON OPTICAL MANUFACTURING CO.**
3202-04 Carroll Ave., Chicago 24, Ill.

Manufacturers and designers of precision optics for scientific equipment since 1926.

9215



Simpson Optical Manufacturing Company, 3202-04 Carroll Ave., Chicago 24

Send me free literature describing the VERNAC Optical Measuring Instrument.

Name

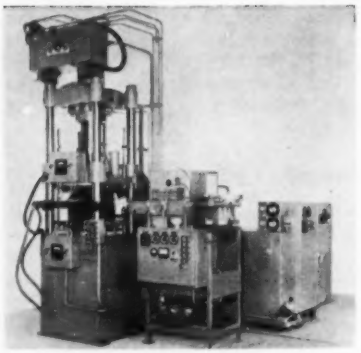
Company

Street Address City Zone State

USE READER SERVICE CARD, CIRCLE 36

## Plastic Molding Machines

Automatic transfer and compression plastic molding machines have top and bottom hydraulic ejection systems; positive air hold-down or hold-up to insure parts remaining in desired portion of mold; insulated die mounting plates to keep the heat in the mold and the press platens and hydraulic system cool; and efficient part removal on both top and bottom ejection.

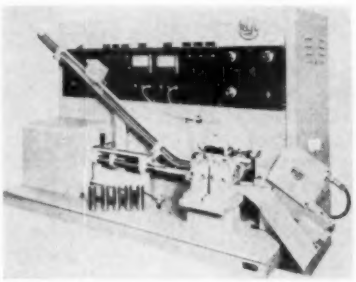


An automatic preheater leader, which has a Girdler dielectric heater, feeds a controlled number of preforms to the transfer pot on any of the 100, 150, 200 or 300-ton units. The loader can be adapted to existing semiautomatic or manually operated molding presses already in operation.

Rogers Hydraulic, Inc., 7401 Walker St., Minneapolis 26, Minn. **Circle 371**

## Hardness Tester

Electronically operated, this instrument can be fed manually or receive parts directly from a processing machine. It automatically measures the hardness of piston pins at rates of up to 2400 per hour and sorts them into acceptable and reject categories. The pins are cross-fed under two standard hardness penetrators whose load can be changed for various scale ranges.



The machine will test roller bearings, ball bearings and similar products. Penetrators may be diamond-tipped or ball-pointed.

Radio Corporation of America, Industrial and Automation Div., 12605 Arnold Ave., Detroit 39, Mich. **Circle 372**

USE READER SERVICE CARD ON PAGE 131 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

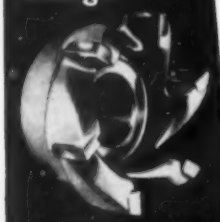
## Thin-Section Bearings

Many sizes of Reali-Slim CP bearings are 34 percent as wide and 15 percent as heavy as comparable conventional bearings of equal bore. Ninety sizes, with from 4 to 12-in. bores are available. Off-the-shelf widths and cross sections range from ¼ to 1 in. The lightweight bearings have Conrad deep-groove ball radial construction and a one-piece snap-over separator. Applications include machine tools, missiles and devices where minimum bearing space and weight are desirable.

The Kaydon Engineering Corp., Muskegon, Mich. **Circle 373**


SANDVIK
Coromant
Carbide-Tipped
SHELL END MILLS

Have Exclusive Triple-Economy Design



Coromant S 26
For Face Milling and Square Shoulder Milling. Available in 3 sizes.

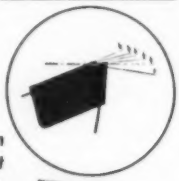
Coromant S 27
For Heavy Duty Face Milling. Available in 3 sizes.

SS 182

❶ FASTER, EASIER, REGRINDING
Coromant teeth are seated at higher angle than is required by the radial rake. You simply grind a suitable primary land along the cutting edge rather than taking off the entire top surface of the blank as required by conventional type. Coromant saves time and grinding wheels.

❷ LONGER TOOL LIFE
Streamlined Coromant body minimizes the amount of carbide removed in regrinding. You retain far greater tip thickness for the life of the cutter than is possible with conventional designs.

❸ EASIER, MORE ECONOMICAL CHANGE OF RADIAL RAKE
Coromant cutters have extra "angle capacity" . . . require less carbide removal.



*For complete data on all sizes of these Coromant mills ask for this free folder.*

SANDVIK STEEL, INC.
1702 Nevins Road, Fair Lawn, N. J.
SW 7-6200 • In N.Y.C. AL 5-2200
CHICAGO
230 N. Michigan Ave., FR 2-5638
CLEVELAND
8650 Brookpark Rd., ON 1-3205
DETROIT
14131 Puritan Ave., BR 3-8474
LOS ANGELES
3338 South Malt Ave., RA 3-9116
In Canada
SANDVIK CANADIAN LTD., Montreal, Toronto, Vancouver

USE READER SERVICE CARD, CIRCLE 37

## Engraving Machine

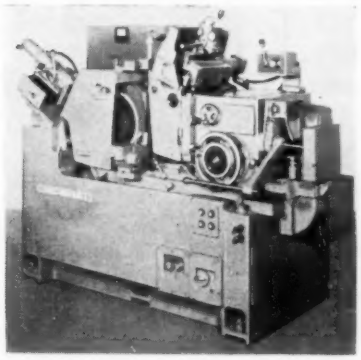
The tracer guide feature of this Engravograph Model ITX allows an unskilled operator to produce precision work from a master template. The engraver, of heavier construction than previous table top models, does two kinds of jobs. As a marking tool, it makes signs and nameplates; engraves names and numbers on parts, tools and bins; and engraves legend plates, dials and knobs. As a production tool, the machine does slotting, profiling, milling and other jobs.

The machine cuts 1/16 in. deep into cold-rolled steel in one pass and 1/8 in. in nonferrous metals. It covers a 12 x 3½-in. area in one setup. Twenty-one different ratio settings range from 2:1 to 7:1 and can be changed without disassembly.

New Hermes Engraving Machine Corp., 154 W. 14th St., New York 11, N. Y. **Circle 374**

## Centerless Grinder

Designed for short-run work, quick and easy change-over, and operator convenience, the Centuramic 210-6, a 10-hp machine, handles up to 3-in. OD work. It has a wheel width of 6 in. with provision for counterbored wheels up to 8 in. wide.



Construction of the machine allows the operator to stand close to the work for dead passing or workblade adjustment. The regulating wheel truing adjustment is inclined 20 deg, opening the throat for easy access. There are no obstructions at any setup or operation position.

The line includes the 220-8, a 20-hp grinder with standard wheel width of 8 in.; the 325-12, 25 hp, 12-in. width wheel; the 330-15, 30 hp, 15-in. width wheel; and the 340-20, 40 hp, 20-in. width wheel.

Cincinnati Milling Machine Co., 4701 Marburg Ave., Cincinnati 9, Ohio. **Circle 375**

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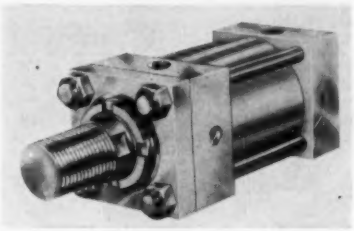
## Hydraulic Cylinders

Interchangeable, heavy-duty, high-pressure, hydraulic cylinders for 2000



psi and 3000 psi nonshock have a range of bore sizes from 1⅛ to 12 in. They are available in 23 mounting styles with four different rod ends.

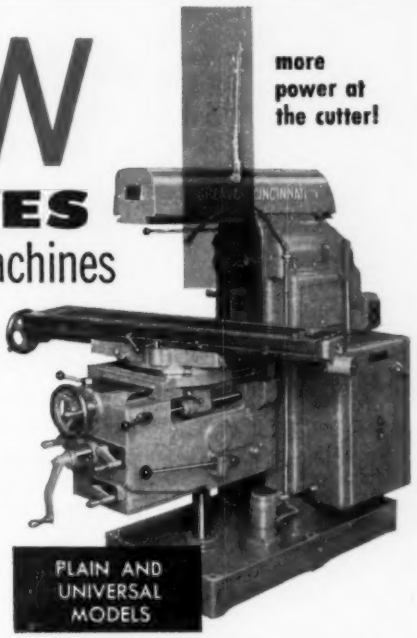
The S-P Mfg. Corp., 30201 Aurora Rd., Solon, Ohio. **Circle 376**


new

more power at the cutter!

GREAVES

2-XH Milling Machines




PLAIN AND UNIVERSAL MODELS

The completely new GREAVES No. 2-XH Milling Machine brings added versatility, increased operational ease, and more power where it's needed most . . . *at the cutter!*

It utilizes two motors, one for spindle drive; a separate motor for moving table, saddle and knee. Compare this and the other outstanding features of the new Greaves Mill. You'll see why Greaves is "The MOST Mill for the LEAST Money."

- Wide range of speed/feed combinations for any type material, any type job.
- Heavy, internally ribbed column casting and heavy duty rectangular overarm for maximum rigidity.
- Large, heavy-duty knee, saddle and table provide accuracy for all types of milling.
- New 7½ HP spindle drive motor, with separate motor for movable components, provides extra power for heavy milling.
- Easy-to-reach controls. Handwheels and vertical crank disengage automatically when not in use.
- New rapid traverse lever within operating control area.
- Separate drive motor for table, saddle and knee provides more smooth balanced power at the cutter.

*Write for detailed literature!*

GREAVES

J. A. FAY & EGAN COMPANY

2303 Eastern Avenue, Cincinnati 2, Ohio

USE READER SERVICE CARD, CIRCLE 38

# FOR NUMERICAL CONTROL AT LOWEST COST

Illustrated here is a Gorton Mastermil with O-16A Super-Speed Spindle Head and Ram Assembly with G. E. Mark II Numerical Control System

## GORTON NUMERICAL CONTROL

### *is field tested and proved in use*

This is how Gorton Numerical Control saves you money on short runs:

- — eliminates elaborate and costly tools, dies, jigs and fixtures
- — wastes no time because operator does not "pace" the work
- — makes no mistakes because operator skill not required
- — extreme, repetitive accuracy is easy and automatic
- — change overs in set-ups can be made quickly
- — signals operator when tool changes are needed
- — guides cutter in close quarters without damage to work or cutter
- — making punched tape is simple typewriter operation

Punched tape . . . or magnetic tape control . . . is available to you on SIX standard Gorton machines and also on Gorton custom-designed machines. You'll be agreeably surprised when you learn the low cost of Gorton Numerical Control and how much more it gives you for your money. For full information write

*Saves You Money on —*

- face milling
- side milling
- end milling
- straight line cavity milling
- slotting
- drilling
- reaming and boring

Your letterhead inquiry will receive prompt attention.

GORTON

SINCE 1893

GEORGE GORTON MACHINE CO.

2612 Racine St. • Racine, Wisconsin

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

**Ralph W. Smith, left, has been appointed executive vice president of the Clippard Instrument Laboratory, Cincinnati. Associated for the past six years with Coil Craft, Inc., Mr. Smith will be in charge of the manufacturing and marketing of all Clippard products. He has been associated with RCA's Home Instrument Div. and the Phileo Corp.**

**Richard P. Simmons, right, has been named manager of quality control at Latrobe Steel Co. He will organize, coordinate and direct the company's newly organized quality control department. A graduate of MIT, Simmons was formerly manager of processing for Titanium Metals Corporation of America. He has spent seven years in the metallurgical field.**

# Men at Work

FRANK P. KELLY has been appointed manager of manufacturing operations for the Philadelphia-based Brown Instruments Div., Minneapolis-Honeywell Regulator Co. He succeeds FRANK M. REA, who has been assigned to Honeywell's Industrial Products Group as a consultant in engineering, tooling and subcontracting.

Chief engineer T. F. DIXON has been named director of engineering for Rocketdyne, a division of North American Aviation, Inc., following integration into the division of the solid propulsion activities of the former Astrodyne, Inc. P. R. VOGT, former assistant chief engineer, has been promoted to the post of chief engineer of the company's liquid propellant engines division.

ROWLAND F. SCHWENKER has been appointed vice president and general superintendent of PIC Design Corp., a subsidiary of the Benrus Watch Co., Inc. One of the principal founders of the corporation, Schwenker has spent 25 years in the precision gear and component field. He has been associated with the Control Instrument Corp., J. H. Mauer Co., Ford Instrument Co. and Haxter Gear Co. He has been with PIC for five years.

DR. BENJAMIN P. BLASINGAME, former head of the astronautics department at the U. S. Air Force Academy, has been named to General Motor's highest defense engineering post. A leading missile and space expert, he will serve as director of engineering for the AC Spark Plug Div. of G. M. operations in Milwaukee.

The Materials and Ceramics Div. of Gulton Industries, Inc. has announced the appointment of DAVID A. LUPFER as general manager. ROBERT DAY has been named general manager, Gulton Instrumentation Div.; DR. ROBERT C. SHAIR, director of research, Alkaline Battery Div.; and HARLAN P. TRIPP, manager of the Ceramics Coating Dept.

Announcement has been made of the appointment of STEPHEN J. JATRAS as director of engineering of the Lockheed Electronics and Avionics Div. (LEAD). Jatras joined Lockheed in 1956 as a staff scientist in the Missiles and Space Div. He transferred to LEAD when the electronics division was formed last March. Before joining Lockheed, he was vice president and chief engineer of Midwestern Instruments, Inc.

**Albert O'B. Andrews has been appointed president of the American-Standard Industrial Div., Detroit. He has been associated with the company for nine years and has served as assistant secretary, assistant to the president, vice president of American-Standard Product (Canada) Ltd., and vice president and controller of the Industrial Div.**

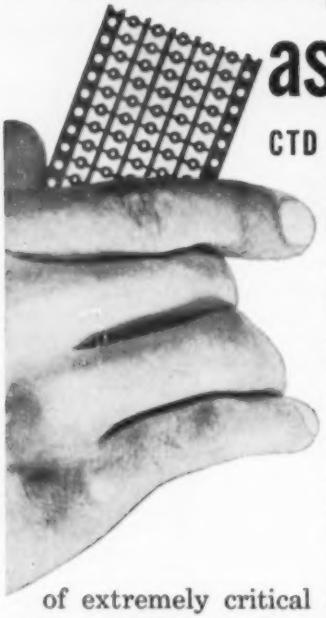
**Richard P. Villwock has been named research engineer for the Michigan Abrasive Co., Detroit. Villwock has been associated with the research center of Libby-Owens-Ford and the metallurgical research section of Electric Autolite. Most recently, Villwock was with the Midwest Abrasive Co., Owosso, Mich., where he served as research director for nine years.**

**Announcement has been made of the appointment of Robert G. Vance to the post of chief development engineer at The Elwell-Parker Electric Co., Cleveland. In his 14 years with the company, Vance has served as design engineer and chief draftsman. In his new position, he will direct research on new products and administer engineering development.**

**Earle V. Schirmer has been appointed chief engineer of Brooks & Perkins, Inc., Detroit. Prior to his recent promotion, Schirmer served as chief design engineer for the company. J. S. Kirkpatrick, vice president-research and development, will continue to handle industry contact on research and development, as well as new products and planning.**

Cleveland Tool and Die
CASE FILE

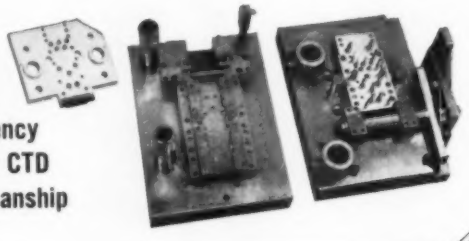
# Reliability and quality assured to .001"



## CTD PRECISION SECTIONAL DIES ASSURE QUALITY OF TEXAS INSTRUMENTS TRANSISTORS

Check the transistors in the next portable radio you hear, and chances are they'll read "TI" – trade mark of Texas Instruments Incorporated of Dallas, Texas. This aggressive company supplies leading manufacturers of computers, missiles and electronic equipment. For contour ground dies of extremely critical tolerances, TI chooses CTD sectional dies to stamp the tab sheets for the ultra-small semi-conductor wafer assembly within the transistor header. "Reliability and quality assured to .001" are musts," says Texas Instruments.

Another example of the important production efficiency made possible by CTD precision craftsmanship



Cleveland Tool and Die means precision...

Dies, Jigs, Fixtures and Special Purpose Tooling

Send for brochure describing CTD's plant and facilities. FREE!

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USE READER SERVICE CARD, CIRCLE 40

## Men at Work

LEO A. MILEWSKI has been elected to the newly-created position of vice president for quality control and service of Landers, Frary & Clark. He has been with the company for 30 years.

PAUL R. TOTTEN has been appointed works manager of the Cleveland Mill Div., Chase Brass & Copper Co. Prior to the appointment, he was divisional superintendent at the Allenport Works of Pittsburg Steel Co.

**Keith A. Hill, above, has been appointed chief engineer of new product development for the Besly-Welles Corp. With the company since 1949, Hill has worked in machine and tool design, has served as advertising manager, and has done work on cutting tools and disk grinders. He was recently a joint recipient of the Mechanix Illustrated Award for outstanding achievement in amateur-built aircraft.**

Nice Ball Bearing Co., a division of Channing Corp., has announced the promotion of THOMAS E. SPENCE to the position of vice president-engineering and that of F. RUSSELL SMITH as chief engineer.

JAMES S. LAIDLAW has been elected vice president and general manager of Hycon Mfg. Co. EDMUND W. BAKER, formerly with Rheem Mfg. Co., will succeed Laidlaw as vice president-engineering and chief engineer.

CARL DECINA has been named plant superintendent by the Rolle Mfg. Co., Inc. He was with Alcoa for 19 years in production management capacities and was recently plant superintendent for the Superior Bearing Co., Buffalo.

Crown Cork & Seal Co., Inc., has named ROSCOE H. BOWERS director of engineering. After 25 years of experience in the administration of diversified industrial engineering programs, Bowers joined the Crown organization in 1958.

## Men at Work

**Dr. Dillon Evers, above, has been appointed to the management committee of Sharon Steel Corp. He will consult with heads of company departments and work with technical societies and universities. Formerly associate director of metallurgy with Mallory-Sharon Metals Corp., he has served as consultant to General Motors Corp., Globe American Corp. and Boeing Airplane Co.**

**The Heald Machine Co. has announced the appointment of George H. Lockwood, above, as manager of development and research. Lockwood has been with the company since 1946. For more than 12 years he was supervisor of grinding engineering before being put in charge of special projects. He has also specialized in machine design and electronics.**

Barry Controls, Inc. has announced the promotion of A. S. "MIKE" CHIVERS to the newly-created post of manager of the Watertown, Mass. Div. RUSSELL LOWE, who has been chief engineer at the Watertown plant, will replace Chivers as manager of the company's western division at Burbank, Calif.

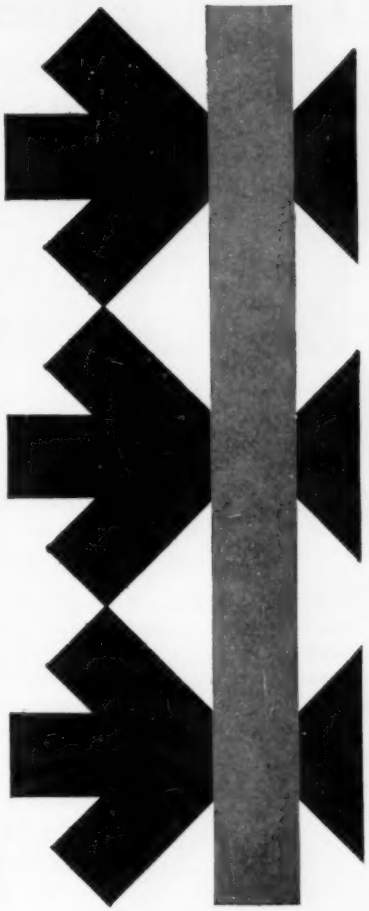
C. ROBERT STONE has been named chief production engineer at Potter and Brumfield Div., American Machine & Foundry Co. He will be responsible for all facets of production engineering including tooling, methods, processing, equipment development and quality control.

**Dr. John L. Zambrow, above has been named director of engineering for Sylvania-Corning Nuclear Corp. Previously associated with the Cutler-Hammer Mfg. Co., Battelle Memorial Institute and the Ohio State University Research Foundation, Dr. Zambrow has been with Sylcor for the past 10 years, most recently as manager of the metallurgy department.**

DR. KARL G. KESSLER has been appointed chief of the Spectroscopy Section of the National Bureau of Standards. In this capacity he will direct work in interferometry, analysis of spectra, and the study of hyperfine structure and isotope shift in spectra. He will continue to head the Bureau project to develop a new wavelength standard of length utilizing atomic beams as a light source.

**Ross Russell, right, has been named manager of industrial engineering at The Timken Roller Bearing Co. He has been with the company since 1942 and, for the last four years, has served as division industrial engineer of the Steel and Tube Div. Tarzan Monda, left, who has been with the company since 1946, succeeds Russell as division engineer.**


V&O
LONG
SLIDE
PRESSES



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the most inherently accurate inclinables you can buy—and so the most logical for mechanized or automated operations.

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V & O Presses and Feeds

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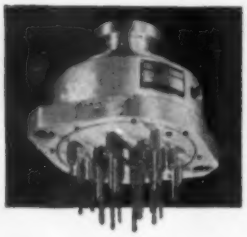
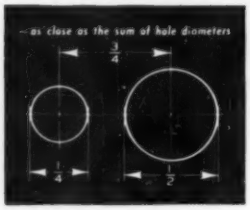
# ZAGAR HEADS for Drilling · Reaming · Tapping

**FOR ANY NUMBER OF HOLES, IN ANY MATERIAL, IN ANY PATTERN, ON ALL CENTERS**



**FIXED CENTER HEADS**

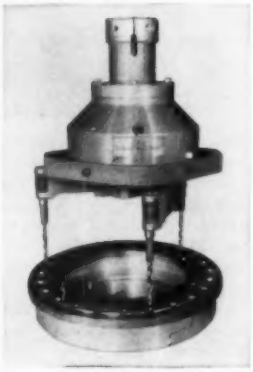
Up to 1500 holes can be drilled simultaneously by Zagar heads. In addition, Zagar can design "salvageability" into fixed center heads to give flexibility and changeability. Get Engineering Sheets 66-68-A.




**ADJUSTABLE SPINDLE HEADS feature:**

**no universal joints**
**no bulky gear clusters**
**no flexible shafts**

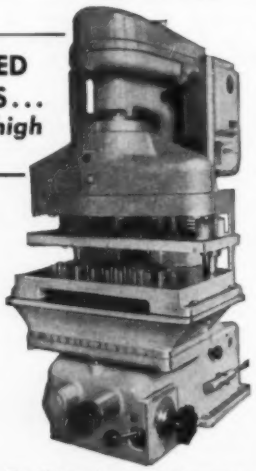
Gearless drill head principles are incorporated in Zagar's exclusive adjustable spindle head. Adaptable on any standard drill press. Great flexibility within a bolt circle diameter of 23". Reworkability extends the life of Zagar heads to cover limitless jobs of varying hold patterns. Write for Bulletin 458.



**COMPLETE, TOOLED "PACKAGE" UNITS... *for economical, high production.***

More holes at less cost per hole simply states the Zagar goal. Whether it is through special machinery, "packaged drilling", or one of many heads, Zagar engineers strive to increase your hole production at reduced cost. Illustrated are basic Zagar lines. From these emanate hundreds of individual solutions to meet the challenge — more profit at lower cost. From these hundreds of Zagar heads have been drilled millions of holes at costs of literally pennies per part. Send us your parts or drawings for a study of hole cost reduction.

*Write for Engineering Manual E-12.*



*Drill head mounted on air-oil press, completely self-contained — all by Zagar.*

**Zagar INCORPORATED**

23892 LAKELAND BLVD.
CLEVELAND 23, OHIO

**TOOLS FOR INDUSTRY and SPECIAL MACHINERY**

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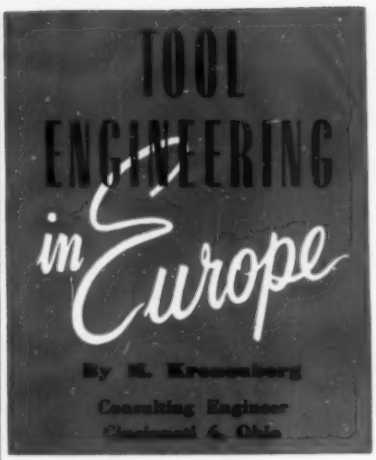


### Healing Effects in Tools

It may appear far-fetched to relate findings in the gemstone industry to tool engineering problems; however, an article published by W. F. Eppler in *Deutsche Goldschmiede Zeitung*, Vol. 57 (7), 1959, p. 376-378 on the healing cracks in gemstones seems to be in line with the finding of the healing effect of high temperatures on cracks in carbide tools.

Referring first to the above-quoted article, three types of healing were found in aquamarine. One is parallel to the "C" axis of the crystal. Another is parallel to the base plane and a third has no orientation. The first type consists of inclusions of liquid which develop during healing into long-drawn shapes parallel to the "C" axis.

The second type is probably caused by a primary crystal inclusion which causes a small healing to form within the crystal during the growth of the aquamarine. The third type is a result of rapid growth of the parent crystal.

As far as tool engineering is concerned, healing effects have been observed in carbide tools. It appears possible to this writer that similar deformations and reformations may occur in the crystals of a cutting tool. The healing effect in tools was first discussed by W. Dawihl and E. Klinger in *Zeitschrift des Vereins Deutscher Ingenieure*, Vol. 100 (13), 1958, p. 562, under the title: "Standzeit und Wirtschaftlichkeit oxydkeramischer Drehwerkzeuge."

In their tests a healing effect was found when using tungsten carbide tools with 6 percent cobalt, confirming the possibility of increasing tool life with increasing cutting speed. The tests were carried out on a limited scale, without presenting a theoretical approach. Dawihl and Klinger refer to the so-called "adhesive temperature" (Klebe-

*Gaertner Toolmakers' Microscope used to measure typical piece part. Co-ordinate range 4" x 2".*

**Precise measurement to 0.0001" and 1 min. of arc**

**Gaertner Toolmakers' Microscope**

Here is a reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. Ideally suited for making a wide variety of precision measurements and is especially valuable in reducing rejects in production work.

With the Gaertner Toolmakers' Microscope you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear. It is a basic measuring instrument for inspection depts., gage labs, tool and die and model shops, industrial and research labs.

The Gaertner Toolmakers' Microscope has been proven in use by U. S. Government Gage Laboratories, and by prime contractors and their subcontractors. With all parties using the same measuring instrument, inspection procedures are co-ordinated and disagreements and rejects minimized.

*Features that help you get*
**HIGH SETTING AND REPEATING ACCURACY**

- Low, compact built-in rotary stage reads to 1 minute of arc throughout 360° range.
- Minimum overhang of stages.
- Full 2" precision-lapped lead screws with correction device.
- Straightforward, direct, uncomplicated optical system.

*Features that assure you of*
**EASY, CONVENIENT OPERATION**

- Independently rotatable cross hairs in protractor ocular speed up measurements, simplify measuring procedure.
- Convenient location of ocular eyepieces for ease of reading.
- Built-in transformer and plugs for all illuminators.

*Modifications and accessories to*
**MEET YOUR EXACT REQUIREMENTS**

- Thread and radius templates, camera and spotting attachments, fine motion focus, variable magnification available.
- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

**Write for Bulletin 147-56**

*Designed and manufactured by*

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## Tool Engineering in Europe

Temperatur) which is the temperature at which a cube of 6mm edge length sticks to the chip material at a pressure of 300 Kg/sq mm (= 420,000 psi). This temperature is used as a criterion in the tests.

An investigation of the healing effects in crystals and tools may be a worthwhile project for ASTE research.

### Honing Small Parts

Honing is a method particularly well suited for the production of small workpieces of high accuracy, according to G. Haasis, who has published an article in *Technische Zeitschrift fuer praktische Metallbearbeitung*, Vol. 53, (3), 1959, p. 89-93, under the title: "Honen in der Kleinteile Fertigung."

Honing of small holes for many materials from cast iron and steel to glass and graphite is discussed. Diamond-impregnated tools are often required for obtaining the desired precision. The honing tools are described and the machine tools used by the author (horizontal boring machines). Tools may have diameters as small as 0.070 inch in the case of diamond tools, where the diamond layer is attached by an electrolytic process. At either end of the cutting portion of the tool a plain steel shaft is left to permit correct alignment. High cutting speeds are used.

### Feedback Controls

Many possible faults can affect the productive stability and accuracy of machine tools with feedback control. J. Peklenik has studied the problems involved for maintaining the accuracy of this type of machinery and reports on his findings in *Industrie Anzeiger*, Vol. 81 (54), 1959, p. 839-846, under the title: "Zur Fertigungs Stabilitaet Messgesteuerter Werkzeugmaschinen."

In the introductory paragraphs, the author discusses the changes taking place in measurements during a grinding operation and describes the fundamental structure of an automatic controlling device. Details are given regarding the factors which affect dimensional accuracy.

The author indicates that the following items influence the stability of an automatic control machine: tool wear; elastic, plastic and thermal deformation of the machine, the workpiece and the tool; failures in the measuring instruments, setup, "off" and "on" control and so on. Each of these factors is examined and technical criteria discussed.


*Hardened, Tempered and Ground-from-the-Solid!*

*It pays to specify*

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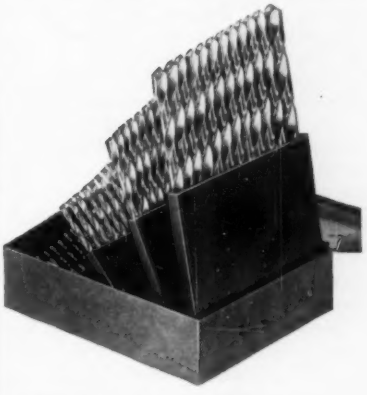
Premium Quality High Speed Steel, Solid Carbide and Carbide Tipped.



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Uniformly hardened high speed steel reamer and drill blanks precision ground to new close tolerance limits available in standard Fractional, Wire and Letter series sets.

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**ACE DRILL**
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ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

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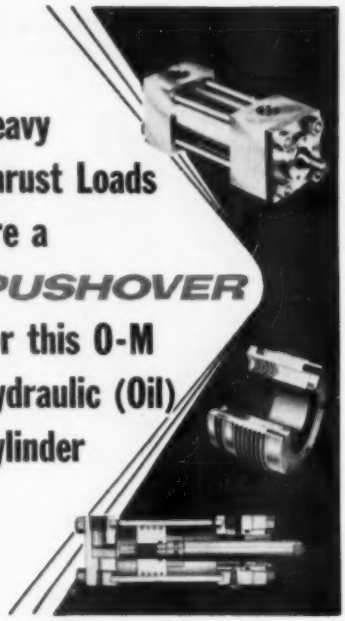

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**SERIES TH**
**2000 psi Operation**
**3000 Non-Shock**
**Available in 1½" to 8" bores**
**Meets JIC Standards**

MANY construction, design and engineering advantages contribute to the power-loaded thrusts of this heavy-duty O-M component. It is ruggedly constructed—all steel and bearing bronze. It is designed right to seal right against power loss. The large ports conduct an unrestricted flow of fluid to the piston, assuring full power. Cushion ball check valve provides for full power starts of return strokes.

The high tensile steel, chrome-plated, standard or oversize, piston rods have a high yield point for higher load capacity. And the rod gland cartridge, threaded for easy removal, is piloted in rod head to assure perfect alignment undisturbed by heavy load stresses. In most installations, cartridge can be removed without removing mounts or tie-rod nuts. A complete selection of mounts is available.

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## Tool Engineering in Europe

### Making Sintered Steel

F. Eisenkolb has published an article in *Stahl und Eisen*, Vol. 79, (19), 1959, p. 1345 ff, dealing with a comparison of different methods for the manufacturing of sintered steel, with densities exceeding 7.0 gr/cm³ (=0.25 lb/in.,³) under the title: "Vergleich der verschiedenen Verfahren zur Herstellung von Sinter-Stahlteilen mit hoher Dichte."

He has investigated the influence of the particle-size distribution of the agent added to facilitate gliding and of the compression and sintering time. The report also covers results of tensile strength tests, elongation and of various alloying elements. The author says that it is advantageous to employ a relatively low prepressure and a low temperature in the first sintering operation, and recommends an addition of 0.8 percent P for duplex compacting with liquid phase. A particularly high density and high physical properties are thus obtained.

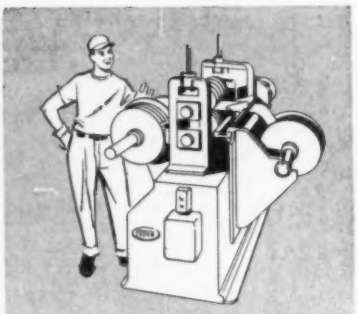
In the discussion which followed the presentation of the paper before the Association of German Mining Engineers and Mechanical Engineers, the problem of heat treatment of sintered steel parts by addition of copper was discussed.

### Metal Cleaning Hazards

An investigation was made in Switzerland of the effect of trichlorethylene and similar agents used in industry for removing fatty layers on metal parts before machining or forming. The results were published by E. Grandjean, director of the Institute for Industrial Health in *Industrielle Organisation*, Vol. 28 (7), 1959, p. 213-226, under the title: "Die arbeits-hygienische Bedeutung von Tri und Perchloraethylen."

The author concludes that inhaling high concentration of the gases of these agents is highly dangerous for the operator, causing unconsciousness in light cases and death in severe cases. Repeated exposure to small quantities of these gases is likewise dangerous when extended over several years. It is therefore necessary to use an apparatus which prevents the escape of gases and also to instruct foremen and operators in the handling of the aforementioned cleansing agents and in the proper ventilation of the shop.

The author concludes that the use of trichlorethylene, etc., can be recommended when the safety regulations are strictly followed, and bases his recommendation on the fact that these chemicals are not flammable and are explosion-proof.

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**YODER SLITTERS**

*basic equipment for cost-conscious users of strip!*

To help meet the demands of tight production schedules, YODER Slitters reduce mill-width stock quickly and economically to desired widths. If your needs are as low as 100 tons per month, time and manpower savings alone will offset the cost of your YODER Slitter in a matter of months, while reducing basic inventories. Compactly designed, standard YODER Slitters are built to handle standard coil widths . . . completely engineered lines for special requirements.

YODER accessories, such as coil cars, swivel unloaders, scrap choppers, scrap disposers, plate levelers and coil boxes, make stock handling fast and easy.

YODER also makes a complete line of Cold Roll-Forming equipment and Pipe and Tube Mills. To profit from YODER'S years of engineering and service experience, contact your local YODER representative or send for the fully illustrated descriptive, YODER Slitter Manual; it's yours for the asking. Write to

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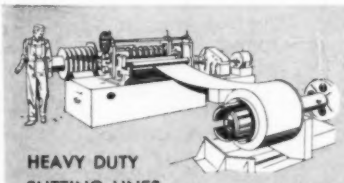
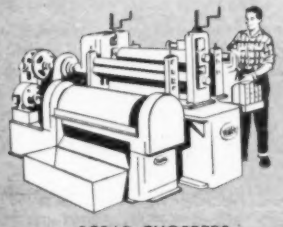


HEAVY DUTY SLITTING LINES



SCRAP CHOPPERS

ENGINEERING YODER MANUFACTURING **ROTARY SLITTING LINES**

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# Trade Literature

*for free booklets and catalogs—use request card, page 131*

### Electric-Eye Reference Manual

A 16-page booklet describes miniaturized electric-eye applications for counting, sorting, monitoring, assembling and automatic weighing applications in packaging, printing and general production. Equipment described ranges from direct or partial cutoff to reflector type units.

The manual contains an expanded section dealing with specific in-plant installations and schematics which show the versatility of the electronic instruments. Technical and specification data includes dimensions, circuitry, speed, monitoring and relays. Bulletin No. 571. Photomation, Inc. **Circle 301**

### Air Control Valves

Minimum and maximum capacity coefficients for a line of directional air-control valves are highlighted in the revised brochure, "Hannifin Valve Finder."

The brochure includes an engineering formula for use with flow control data; a section explaining valve terms and principles; and a three-step outline covering valve types, means of actuation and operating principles. Hannifin Co. **Circle 302**

### Industrial Use of Isotopes

Twelve-page booklet, "Industrial Radiography With Radioisotopes," describes equipment and methods of radiographing of all kinds of industrial products. The advantages peculiar to isotopes in raidography, the selection of the proper isotope for a particular job and methods of making radiographic exposures are discussed. The booklet also contains a chart of equivalent energies showing typical exposure times required to radiograph various materials of varying thicknesses with some of the popular isotopes.

Other sections explain how to solve the half-life problem of isotopes without downtime on the unit and list various radiation monitoring devices. The publication also outlines services available through the new Picker Research Center, Picker X-Ray Corp. **Circle 303**

### Automatic Control Cylinders

Bulletin 91017 describes a line of air, water and oil cylinders and valve-cylinder combinations for automation applications. The 24-page, illustrated bulletin supplies specifications, ordering information, outstanding features and dimensions. Airmatic Valve, Inc. **Circle 304**

### Socket Screws

An eight-page bulletin covers Unbrako socket head cap screws, set screws, button heads, flat heads, shoulder screws and socket screw keys, as well as precision dowel pins, pressure plugs and square head set screws.

Configurations, sizes, materials, design features and proper installation


How Can Any Hack Saw Cut As Fast As a MARVEL?

GREATER EFFECTIVE FEED PRESSURE

MARVEL Series 6, 6A, 9 and 9A Hack Saws are capable of automatically applying *more than twice the feed pressure* required for most hack sawing jobs. This means that MARVEL Saws can utilize the full strength and heat resistance of the modern composite hack saw blade which is designed to cut most efficiently under heavier feed pressures. MARVEL Dual Power Feed forces the blade to cut as deeply as possible and practical on every stroke—to cut-off the work in the fewest possible strokes by automatically adjusting the feed pressure in relation to the changing work resistance.

*Catalog C85 has complete details, facts and figures on both Marvel metal cutting Hack Saws and Band Saws. Write for it today.*

MORE CUTTING STROKES PER MINUTE

MARVEL Reciprocating Crank Lever Action, providing quick return of the saw frame on the non-cutting stroke produces 33⅓% more *cutting strokes* per minute than ordinary saws *without increasing the peak blade velocity on the cutting stroke.* Result: faster cutting-off without damage to the blade.

With far greater feed pressures automatically available, plus more cutting strokes per minute, is it any wonder that MARVEL Series 6 and 9 Hack Saws will give you faster, accurate cutting-off every time?

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Metal Cutting MARVEL SAWS
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# 16 press operations performed every second

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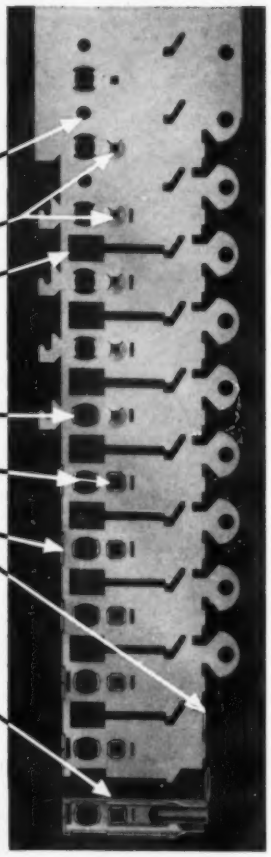
And, the precision and uniformity demanded by one of the nation's quality hardware manufacturers had to be maintained in each of the millions of DOOR LOCK CASES to be produced.




Whenever ingenuity of die design, extreme uniformity and accuracy of piece parts or reliable mass production are problems—rely on B. Jahn progressive dies to add quality and profit to your product.

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LOCK CASE
.040 cold rolled steel
80 pieces per minute

THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

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## Trade Literature

are charted for reference and comparison. Text explanations are supplemented by photographs, line drawings, cutaway views and microphotographs. Properties, applications and features of both alloy and stainless steel socket screws are outlined. Capsule coverage is given to the optional Nylok self-locking feature, to platings and surface treatments, and to the thread fit and gaging services offered industry through the three SPS Metrology Laboratories. Standard Pressed Steel Co. **Circle 305**

### Press Brakes

Specifications of hydraulic press brake models ranging in capacity from 150 to 1800 tons plus design information and photographs of typical models are included in a 16-page catalog. Verson Allsteel Press Co. **Circle 306**

### Carbide Burrs

Solid carbide burrs for use with power hand tools and flexible-shaft machines for cutting metals, plastics, and other materials are described in catalog CB-59.

The catalog includes pictures and descriptions of 14 different solid carbide burrs, selection and application information, and tables of sizes and prices. Thomas C. Wilson, Inc. **Circle 307**

### Die Lubrication

A catalog sheet covering spray guns for die lubrication includes description of an automatic gun for applying lubricating oils or drawing compounds to dies, or all types of coolants to abrasive wheels and to belts. The spray pattern is adjustable from a fine, round shape to a broad fan. Other automatic spray guns for use in similar applications, but varying in size, are listed with full specifications and accessories. The DeVilbiss Co. **Circle 308**

### Magnetic Particle Clutches

Bulletin EPD 6126-3 contains information on bored-rotor and hollow-rotor water-cooled Magnaclutches. The magnetic particle clutch, which can also be used for braking, is designed for applications such as tension control and cycling, where high slippage between input and output rotating members generates excessive heat which must be dissipated rapidly and effectively. The bulletin contains cross-sectional drawings, photographs and charts on the specifications and dimensions of each model. Vickers Inc. **Circle 309**

### Precision Measurement Tools

A guide and catalog of precision measuring tools and instruments, with 96 illustrated pages, contains detailed information on measuring tools and toolroom specialties such as micrometers, vernier depth gages, snap gages, protractors, dial indicators, gage block sets, height gages, speed indicators, hand tachometers, dynometers, radius dressers, optical flats, surface plates, and illuminated magnifiers.

Also illustrated are Zeiss, Scherr, Parkson, Kesel, Cima, Cornelis, Opto, and OMT instruments. Scherr-Tumico. **Circle 310**

### Rivet Setters

A line of single and multiple rivet setters that are air powered and air cushioned in operation are described in a 4-page bulletin. Chicago Rivet and Machine Co. **Circle 311**

### Cutting Fluids Manual

Metal machining with cutting fluids is comprehensively reviewed in a four-color, 115-page manual illustrated with graphs, charts, diagrams and photographs. A brief history of the development of cutting fluids preceeds the three major sections of the manual which cover materials (metals), specific operations, tools and cutting fluids. Gulf Oil Corp. **Circle 312**

### Stainless Cold Heading Wire

A four-page brochure compares the cost, corrosion resistance and cold heading characteristics of the commonly used grades of stainless steel cold heading wire. Chromium and chromium-nickle grades are evaluated. Universal-Cyclops Steel Corp. **Circle 313**

### Die Cushions

Described in a 16-page catalog are pneumatic, hydro-pneumatic and hydraulic types of die cushions. Size and capacity data is given as well as information on typical die cushion arrangements. Verson Allsteel Press Co. **Circle 314**

### Speed Reducers

A 65-page catalog, covering Hi-Line speed reducers, supplements the company's general catalog on stock gears and speed reducers and provides complete engineering data, dimensions and application selection charts on a series of fin and fan cooled reducers. The Ohio Gear Co. **Circle 315**

***New flat rod makes accurate measuring easier***

**Gets Closer to Shoulders** because rod is flat . . . permits measuring at side of hole to avoid extra depth made by drill point. Better for narrow recesses, too.

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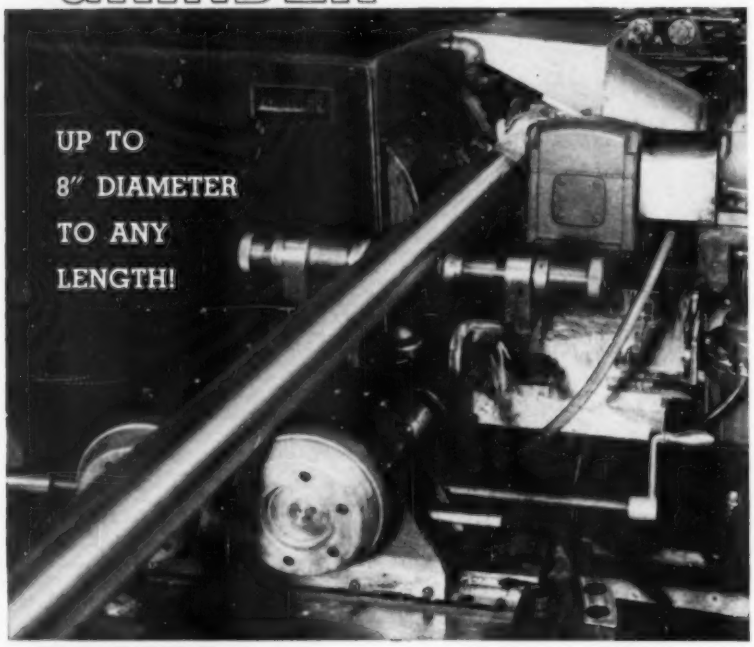


**ENGELBERG 8132-HD**

## removes 3 lbs. metal per minute!

Loaded with "firsts," the Engelberg 8132-HD now makes possible exceptionally heavy single pass stock removal, extremely fine finishes, close tolerances on any rod or tube stock.

**New large workpiece capacity**—precision grinds and finishes any length, takes diameters from 1" to 8".

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**New automatic reverse feed**—microswitch controls automatically change helix angle of outboard support power units and regulating wheel to reverse feed direction for multiple through feed passes; eliminates intermediate material handling.

**New highs in production**—Ex: 416 stainless steel bars 5.060" diameter, 20' length; removal .018" stock per pass at feed rate of 70" per minute. 1020 steel tubes 6¼" diameter, 10' length; removal .015" per pass at feed rate of 3' per minute.

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**Division of SUNDSTRAND CORPORATION**

**BELVIDERE, ILLINOIS**

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## Trade Literature

### Drawing Presses

Steelweld Speed-Draw presses are described and illustrated in an eight-page illustrated brochure. The machines are designed for deep draw work and standard press operations such as forming, blanking, piercing, trimming and light embossing.

Catalog No. 2029-A gives construction details and complete specifications for machines ranging in capacity from 200 tons to 1250 tons. Steelweld Machinery Div., The Cleveland Crane & Engineering Co. **Circle 316**

### Form-Truing

The Diaform principle of form-truing grinding wheels for use in form grinding dies, punches, gear teeth, broaches and additional tools and parts is described in a four-page bulletin which also gives features and specifications of the company's model No. 5 machine. Pratt & Whitney Co., Inc. **Circle 317**

### Pressure Vessels

New techniques for making titanium, stainless steel and alloy steel pressure vessels for the Atlas and other missiles are described in a 12-page illustrated bulletin, No. 141. Included is a performance chart and a full-page nomograph for approximating weights of pressure vessels in various materials. Airite Products, Inc. **Circle 318**

### Specialty Steels

A 40-page reference source for buyers of specialty steels contains detailed information on tool and die steels, stainless steels, high-temperature alloys, electronic, magnetic and electrical alloys, special-purpose alloy steels, tubing and pipe, and fine wire specialties. The Carpenter Steel Co. **Circle 319**

### Plastic Tooling Materials

Compact guide to plastics tooling materials for the metal and plastics-forming industries is titled "Maraset Tooling Resins." The data sheet, supplement to other company-published literature, describes single materials in four product groups—epoxy laminating and coating resins, casting resins, high-temperature resins, and adhesive sealing compounds. Maraglas water-clear epoxy and Marafoam Rigid polyurethane foam are included.

Among end uses indicated for the plastics are fabrications of fixtures, draw dies, foundry tools, vacuum forming and injection molds, and repair of tools and equipment. Marblette Corp. **Circle 320**

### Machine Tool Rebuilding

"Repair, Rebuild or Replace," a four-page brochure, tells how to determine when a machine tool should be rebuilt and modernized. The brochure also tells how to test for accuracy and alignment, and the condition of bearings, gears, shafts, clutches, ways, slides and other components. Gahr Machine Rebuilding Co. **Circle 321**

### Stainless Comparison Chart

New data chart, Sec. A, No. 4, provides a comparison of properties for 18 different grades of stainless steel, including the recently developed precipitation hardening grades, 17-4 and 17-7.

Using bar graphs, the chart compares 9 important stainless factors: tensile strength, yield, izod, creep, machinability, thermal conductivity, scaling resistance, thermal expansion and relative base prices. A corrosion resistance table is also included. Peter A. Frasse & Co., Inc. **Circle 322**

### Motor Control Digest

Descriptive, pricing, technical and engineering information on a line of motor controls is covered in "Allis-Chalmers Motor Control," a 162-page digest, available on request on company letterhead. A quick reference selector guide at the front of the digest makes it easy to find any starter, controller or pilot device in the book. Allis-Chalmers Mfg. Co. **Circle 323**

### Manual Press Controls

Catalog 65b has been completely revised and expanded to 16 pages to give more application data and helpful ordering information. It describes applications of Micro Switch trip control to manually operated stamping machines, air presses, riveters, press brakes, shears, welders and paper cutters. Detailed descriptions and photographs of 15 different installations are included. Micro Switch. **Circle 324**

### Abrasive Finishing

Among other feature articles, "The Abrasives' Workshop" describes treatment of abrasive belt roll grinding on submarine periscopes. Grinding and finishing long tubes of corrosion-resisting steel, 7½ in. in diameter and approximately 34 ft long, is done in less than ½ the time required by traditional methods, and a better finish is developed. The Carborundum Co. **Circle 325**


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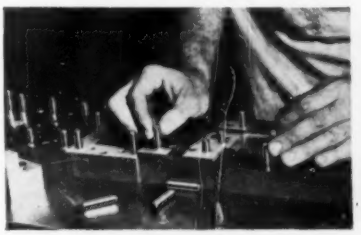

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Wilson "Rockwell" Hardness Testers can help make your products better, stronger, longer lasting. They give reliable results on the production line, in laboratories, in tool rooms, and in inspection departments. They're as easy to use as a center punch, as durable as a machine tool, as sensitive and accurate as a precision balance. That's why Wilson "Rockwell" is recognized as the world's standard of hardness testing accuracy.

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A perfect diamond penetrator is essential to accurate testing. Only flawless diamonds are used with Wilson "Brale" penetrators. Each diamond is cut to an exact shape. Microscopic inspection and a comparator check of each diamond—one by one—assure you of accurate hardness testing every time.

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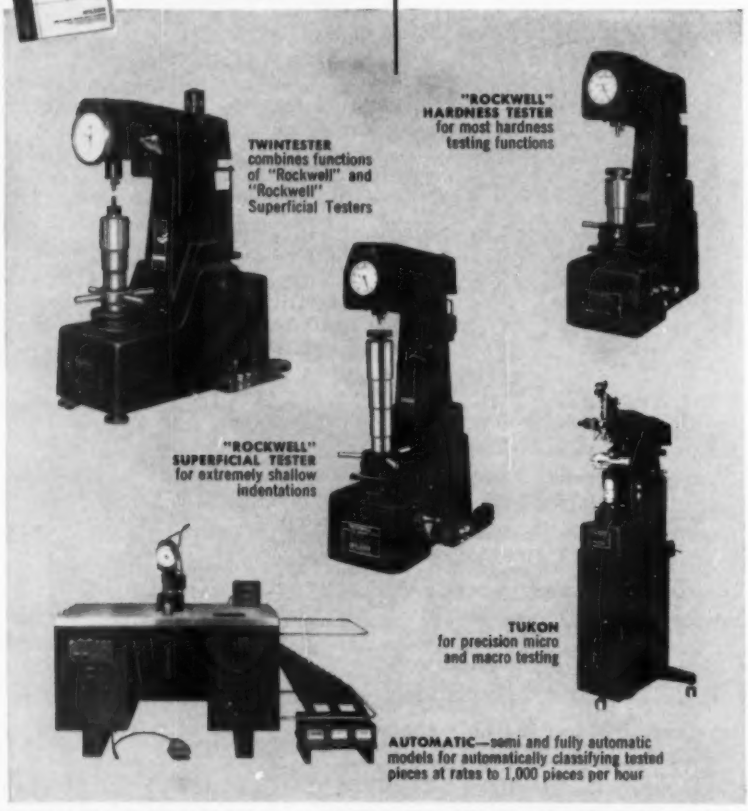
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TOOL ENGINEERS HANDBOOK, SECOND EDITION—*Frank W. Wilson, Editor in Chief. Published by the American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich. Printed by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price ASTE members, $15; nonmembers, $19.50. 2289 pages.*

Long recognized as the most important reference volume in the tool and manufacturing engineering field, the *Tool Engineers Handbook* has been enlarged and completely revised for this second edition. Each section of the original work has been rewritten and brought up to date to reflect the latest manufacturing practice. The 103 sections of the book encompass all phases of tooling for such manufacturing operations as: metal cutting and other machining operations, finishing, gear manufacture, casting, welding, inspection, joining, cold and hot metal forming, screw thread manufacture, materials handling, heat treatment, surface cleaning and coating and balancing. Among new subjects included are developments such as arc and spark machining, electrolytic grinding, explosive forming, numerical control, and supersonic processes.

In addition to up-to-date descriptions of mechanical processes, the handbook includes practical ways of planning, operating, and setting up processing functions. Some of these are: new methods of controlling the economics required to meet the higher cost of manufacturing, predesign and postproduction value analysis, modern methods for better assurance of quality, advantages of learning curves for long-range determination of direct labor costs, and improved inventory practices.

Discussions of cutting tools, covered in a separate section in the first edition, are now included with the related machining process thereby consolidating into one discussion more elements for complete understanding. New standards which have been adopted since the first

edition have been included in the appropriate sections. The format has been changed slightly in that each section is page numbered separately. This enables the reader to locate subject matter more readily.

In all, this edition is not a revision in the usual sense but successful accomplishment of the task of producing a valuable reference volume to fit the modern engineer's needs.

SOLDERING MANUAL—*Prepared by the AWS Committee on Brazing and Soldering. Published by the American Welding Society, 33 W. 39th St., New York 18, N. Y. Price $5. ($4 to ASTE members.) 170 pages.*

The initial chapters in this book are devoted to general soldering principles, joint design, fluxes, solders, precleaning and surface preparation, equipment and procedures, flux residue treatment, and inspection and testing. The remaining chapters treat separately various materials that may be soldered including nickel, aluminum, magnesium and cast iron. Chemical compositions of solders are given, together with flux formulations for various metals. New techniques developed for miniaturization are described.

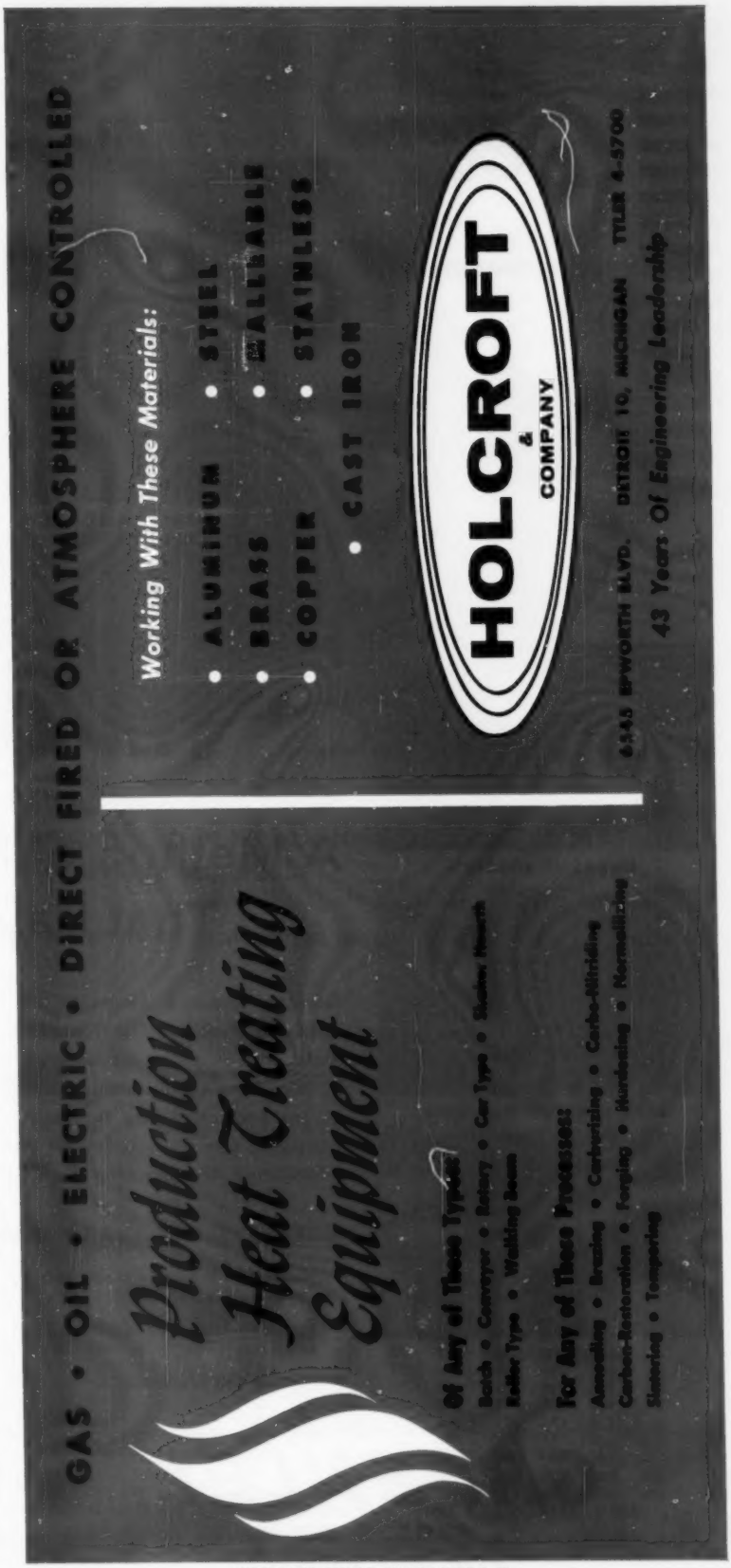
MECHANICAL DESIGN AND ANALYSIS—*By R. R. Slaymaker. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $9.50. 418 pages.*

Setting this text apart from others on the subject is the fact that generalized conclusions are drawn from actual specific case studies. Analysis pertinent to the problem is written into each project. Alternate and exercise problems are given in each case to broaden the scope of theory discussion. Special emphasis is placed on topics most important to a machine designer: limit dimensioning, material selection and repeated stress effects.

MATHEMATICS FOR SCIENCE AND ENGINEERING—*By Philip L. Alger. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $7.75. 360 pages.*

Designed for self-study, this book begins with a quick review of arithmetic and proceeds in logical sequence through algebra, trigonometry, calculus, probability and linear differential equations. Special emphasis is placed on complex numbers, infinite series, and methods of approximation.

Adequate bibliographies at the end of each chapter provide the reader with sources for further detailed study. Based on *Engineering Mathematics* by Charles P. Steinmetz, this book is a lucid and relatively easy-to-follow presentation of mathematical concepts important to engineers.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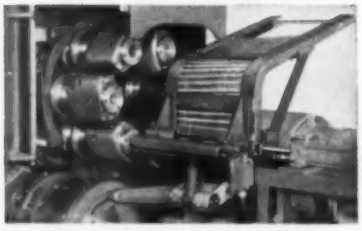

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# Field Notes

**Lehigh University** has received $31,715 through a bequest of the late Roy R. Hornor, a graduate in metallurgy in 1899. This amount will be added to the $25,000 Roy R. Hornor Research Fund established in 1938. Income from the fund is to be used for original research in the field of metallurgy and inorganic chemistry. Holders of the Hornor fellowship devote half-time to research under the direction of the faculty and half to graduate study.

√ √ √

**Diamond Alkali Foundation** has established a financial program to aid higher education in this country. Effective January 1, 1960, the program will provide for direct financial grants to colleges, merit scholarship awards, graduate fellowships and an employee gift-matching plan. A significant part of the total contribution will be allocated for the Educational Grants Program. Schools whose scientific curricula include courses beneficial to the chemical industry will receive direct grants to be administered at their discretion.

## awards

Work has begun on the **United Engineering Center,** an 18-story structure to be erected opposite the United Nations in Manhattan. Former President Herbert Hoover shared groundbreaking honors with Jerry Fujimoto, a freshman engineering student from Hawaii. To occupy the block between 47th and 48th Streets on United Nations Plaza, the center will house 18 of the country's engineering societies.

√ √ √

**Edward L. Roth,** president of Motor Castings Co., West Allis, Wis. has received the Gold Medal, highest award of the Grey Iron Founders' Society. Roth was honored for his many contributions and services to the Society and to industry. Others honored by the Society were Cecil R. Garland of W. O. Larson Foundry Co. and William A. Hepburn of John T. Hepburn, Ltd. The awards were made at the 31st Annual Meeting of the Society in San Francisco.

**Vincent de Paul Goubeau** and **William L. Barth** have been named winners of the two highest awards of the American Standards Association for 1959. Goubeau, vice president and director of materials of Radio Corporation of America, received the Howard Coonley Medal and Barth, retired head of engineering standards at General Motors, received the Standards Medal. The medals were presented at an award dinner held in conjunction with the Tenth National Conference on Standards in Detroit, October 20 through 22.

√ √ √

**Industrial Professional Development Award** will be presented annually by the National Society of Professional Engineers, beginning in June 1960. Recipients of the award will be industrial employers of engineering personnel who make outstanding contributions to the engineering profession through their employment practices.

## acquisitions

**Howell Electric Motors Co.** of Howell, Mich. has acquired The Leland Electric Co., a former division of American Machine & Foundry. Acquisition of Leland, a major manufacturer of electric motors, gives Howell three wholly owned subsidiaries and four manufacturing plants in the United States.

√ √ √

**Meehanite Metal Corp.** of New Rochelle, N. Y., has been purchased by Harry H. Kessler and Associates, St. Louis, Mo. No change in location or method of operation is contemplated and Meehanite will continue to operate as an independent company.

√ √ √

**Wheelabrator Corp.,** Mishawaka, Ind., has acquired Lake Erie Machinery Corp. of Buffalo, N. Y., which will operate as a wholly owned subsidiary. Lake Erie Machinery will continue to manufacture its line of hydraulic and extrusion presses and die casting machines.

**U. S. Industries, Inc.** has concluded arrangements for acquisition of Burtonwood Engineering Co., Ltd. of Lancashire, England. Burtonwood Co. with three plants in England and a subsidiary in Venezuela, has in excess of 200,000 sq ft of manufacturing space and employs approximately 1000 people. Acquisition of Burtonwood gives U. S. Industries its first wholly owned manufacturing business in the European market area.

√ √ √

**Dumore Co.,** Racine, Wis. manufacturers of portable precision tools for milling, drilling and grinding, has acquired Master Manufacturing Co., Inc. of Hutchinson, Kan. Master Mfg. Co. specializes in machine tools of the "building-block" type. Each company will continue to manufacture its specialties but the acquisition will enable Dumore to build and market larger products than was possible in the Racine plant.

√ √ √

**Jessop Steel & Supply Co.** of Washington, Pa. has acquired Chase Steel Co. of Los Angeles, a supplier of stainless steel to West Coast missile and rocket industries. Jessop is a producer of specialty steels such as tool and die steels, armor plate, stainless-clad and precision-ground steels. Chase will be operated as a wholly owned subsidiary of Jessop.

√ √ √

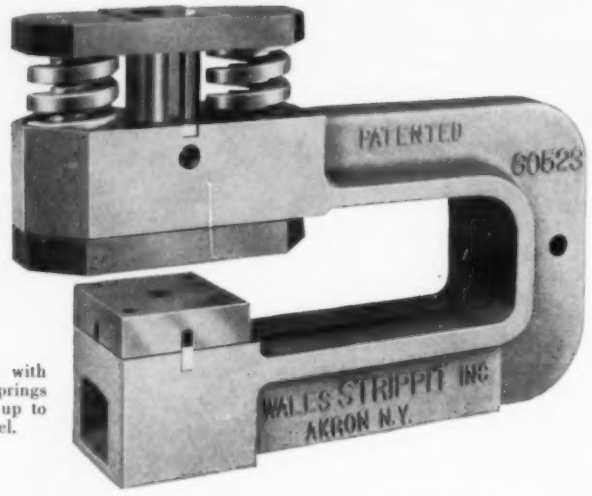
**General Mills** has acquired the business and assets of Magnaflux Corp., Chicago. Magnaflux is a pioneer developer of techniques and methods for detection of hidden flaws in industrial materials. General Mills, one of the world's largest flour milling companies, has widely diversified operations including a Mechanical Division established prior to World War II. Present plans call for an expansion of the Magnaflux line with the company remaining independent of other General Mills Divisions.

## association news

**Midwest Sintered Products Corp.** has been elected to membership in the American Powder Metallurgy Institute, the technology division of the Metal Powder Industries Federation. Located in Chicago, Midwest Sintered Products is a pioneer manufacturer of nonferrous nuts and washers by the powdered metal process.

# new STRIPPIT PUNCHING UNITS

## with DUAL-RANGE capacity!




● Strippit unit with mechanical springs for piercing up to .500 mild steel.

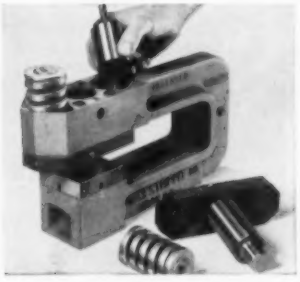
- Up to .500 mild steel, using removable Strippit mechanical springs
- Up to .750 mild steel, with interchangeable Strippit Hydra-Springs
- Convertible from .500 to .750 capacity in seconds, at minimum cost
- One heavy-duty holder for both capacity ranges
- Readily replaceable punch tips and dies — round, obround, square, shaped
- Keyed punch body keeps punches accurately aligned

**USING STRIPPIT MECHANICAL SPRINGS**

| Max. punch dia. | Max. material thickness (mild steel) |
|---|---|
| 1.375 | .250 |
| 1.250 | .375 |
| 1.125 | .500 |

**USING STRIPPIT HYDRA-SPRINGS**

| Max. punch dia. | Max. material thickness (mild steel) |
|---|---|
| 1.375 | .375 |
| 1.250 | .500 |
| 1.125 | .625 |
| 1.000 | .750 |



◀ Mechanical springs are easily replaced with Hydra-Springs for punching up to .750 mild steel.

***WRITE TODAY*** for the new Strippit General Catalog. It covers all details on this and all other Strippit units... plus the savings in tooling and press time effected with the famous cost-cutting Strippit System of fabrication.

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**211 Buell Road • Akron, New York**

UNIT OF HOUDAILLE INDUSTRIES, INC.

*Manufactured in Canada by: Strippit Tool & Machine Company, Brampton, Ont.*

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## Field Notes

### new activities

**Atomic Energy Commission's** Div. of Research has awarded a contract for nuclear research to Lockheed Missiles and Space Div. This is the first nuclear research contract issued to an industrial laboratory. In the past, such contracts have been granted only to universities and nonprofit laboratories. AEC support, which will augment fundamentl nuclear physics research by Lockheed, is for basic studies of the properties of atomic nuclei. The research may also provide useful application in general field of nuclear power.

√ √ √

**Fawick Corp.**, Cleveland, Ohio, manufacturer of industrial and automotive clutches and brakes has established a new Hydraulic-Electronic Division. Fawick's entry into the field of hydraulic components was facilitated by acquisition of New Products Corp. of Stokie, Ill. Fawick plans to transfer key personnel and production equipment to Cleveland.

√ √ √

**Taylor Fibre Co.** has organized an Advanced Materials Div. to investigate and develop laminated plastics and vulcanized fibers for use in rockets, jet aircraft, missiles and nuclear reactors. Operating independently of other Taylor divisions, Advanced Materials Div. is designed for work on research and development contracts for government, industrial and company-initiated projects.

√ √ √

**General Controls Co.** has announced formation of a European subsidiary, General Controls Societé Anonyme (S. A.) at Fribourg, Switzerland. Establishment of the subsidiary will result in a revision of organizational procedures. Effective January 1, 1960, all European orders will be processed through the Fribourg offices.

√ √ √

**General Electric Co.** has received a $7 million order to furnish complete electrical systems for two Ford Motor Co. metal rolling mills. The contract is part of a current Ford modernization and quality improvement program. Both mills are located in the Ford Rouge plant which produces sheet steel for automobile bodies.

## Field Notes

**General Electric Co.** has established a new component to examine the company's varied operations and recommend where and how greater advantage can be taken of the growing opportunities for profitable automation. Called the Internal Automation Operation, the component is headed by John E. Ryan, formerly engineering manager of the company's Home Laundry Dept. Headquarters of the operation, a component of the Specialty Control Dept., will be Schenectady, N. Y.

### expansions

**F. J. Stokes Corp.** of Philadelphia has commenced its third major expansion since 1950. The expansion, scheduled for completion in 1960, will increase the company's manufacturing capacity by 20 percent. Stokes Corp. is a pioneer developer of molding, tabletting and compacting presses.

V V V

**Ling-Altec Electronics, Inc.** has announced completion of a 65,000 sq ft expansion program at Anaheim, Calif. The additional facilities will enable Ling-Altec to consolidate its Culver City and Anaheim operations. Ling-Altec manufacturers high-power vibration-test equipment and sonar components.

V V V

**Chromalloy Corp.,** White Plains, N. Y., has announced plans for expansion of production and marketing facilities in the United States and abroad. Initial steps in the expansion program have been made with construction of new facilities in White Plains and Los Angeles. Chromalloy produces a pure chromium metal, "Iochrome," which was developed in conjunction with Battelle Memorial Institute.

V V V

**Chrysler Corp.** has leased the Paramount Engineering building in Madison Heights, Mich. to house a number of its engineering division activities. A major portion of the electrical design section, part of the body design and interior styling groups will be located in the facility.

Future expansion plans of Chrysler include construction of a multimillion dollar facility in DeWitt, N. Y. The new facility is intended to replace three New Process Gear Div. plants in Syracuse, N. Y.


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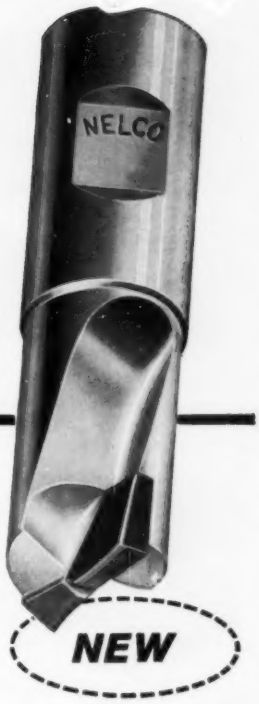
**END MILLS**
**LEAD IN CUTTING**
**ALUMINUM**




This new true helix end mill is the *first* of its kind—Nelco engineered to give superior production performance when plunge cutting and general purpose milling on Aluminum.

Generous carbide tips are ground to give free shearing action, excellent surface finish in plunge and slotting cuts. Short length, added flute strength, greater chip clearance produce a new versatility and dependability on rugged cutting operations.

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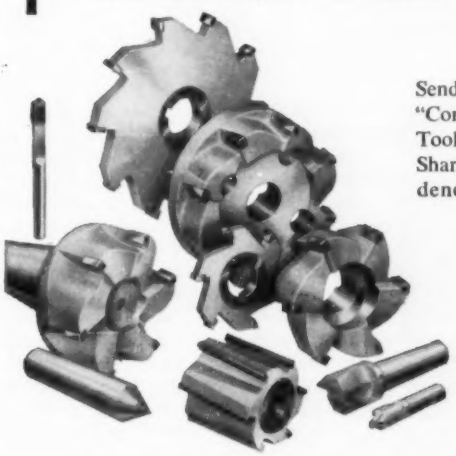

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OSBORN

**BEFORE BRUSHING**
*Corners of intricate multiple contours were hand-filed to remove burrs. Results were inconsistent. Former production rate:* **24** *per hour.*

**AFTER BRUSHING**
*All surface junctures are blended accurately to predetermined specifications. Results are uniform...quality is high. Osborn 3-A Machine production rate:* **63** *per hour.*

# Production up 62% on this finishing job

## ...with OSBORN power brushing

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Formerly, this air conditioner manufacturer finished 24 compressor bodies per hour. He now finishes 63 per hour . . . *a 62% increase in production.* But that's just the start.

Quality now is uniform because Osborn power brushing thoroughly removes all burrs that might ultimately damage the compressor. Each surface juncture of the intricate contour is also formed to an exacting, predetermined blend . . . all automatically.

Your Osborn Brushing Analyst will gladly provide complete details. He will show how you can benefit on similar operations in your own plant.

Write now for full details on Osborn Metal Finishing Machines. *The Osborn Manufacturing Company, Department K-58, Cleveland 14, Ohio.*

Osborn Brushes

METAL FINISHING MACHINES... AND FINISHING METHODS
POWER, PAINT AND MAINTENANCE BRUSHES • FOUNDRY PRODUCTION MACHINERY
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## Field Notes

### new facilities

**Warner & Swasey Co.** is completing its new 40,000 sq ft research center in Solon, Ohio. Located on a 12-acre tract, the facility will centralize the company's research and development activities. Design and experimental areas, metalcutting and metallurgical research laboratories, a fully equipped prototype shop, library, and offices will be housed in the facility. Completion of the center is expected late this year with dedication scheduled for 1960.

√ √ √

**Louis Allis Co.** of Milwaukee, manufacturer of electric motors, generators and adjustable speed drives, has announced construction of a new research and development center in Greendale, Wis. The building, which will be staffed by 100 engineers and technicians, will double the size of present engineering and physics laboratories. Research and development plans include work in the electronic and nuclear areas, permitting greater penetration into industrial and military fields.

√ √ √

**Sundberg-Ferar, Inc.** is constructing a new industrial-design center in Southfield, Mich., a suburb of Detroit. The new facility will include lighted parking areas, an experimental tank for hydrodynamic testing purposes, and a completely modern building for executive, administrative and design personnel.

√ √ √

**Siegler Corp.'s** Hufford Div. has announced completion of a new laboratory to be used for analysis of space-age metals. The laboratory will enable Hufford to evaluate uses of metals in such items as pressure vessels and rocket motor cases. The new facility will be employed for the further development of the Hufford Spin Forge process and its application to missile hardware and assemblies.

√ √ √

**AC Spark Plug,** the Electronics Div. of General Motors, will add 215,000 sq ft to its Oak Creek, Wis. missile guidance plant. Designed to consolidate defense engineering functions, the addition will increase plant space at Oak Creek to more than 700,000 sq ft.

# technical shorts

**Plastic Coated Coil Stock**

Decorative plastic of unusual molecular structure can be bonded to continuous coils of strip steel through a process developed by Enamelstrip Corp., subsidiary of National Steel Corp. The product has been available in the past in the form of expensively processed cut sheets. Inability to control plastic thickness limited use of the material.

Development of the Miracoil coating process enables the manufacturers to control thickness of the plastic coating to within 0.0001-in. tolerance. The coating is both base coat and adhesive, no other bonding agents being required. Pigments added to the base coat provide desired colors. A light top film is added to the base coat to provide a protective film.

An added advantage of the Miracoil process is that it permits use of thermosetting plastics. Thermosetting plastics retain their basic physical properties at elevated temperatures where thermo plastics become soft.

* * *

**Sheet Beryllium Ground**

Sheet beryllium has been ground and polished to a finish equivalent to No. 4 stainless steel at Behr-Manning Co., Troy, N. Y. This is believed to be the first production grinding of beryllium in sheet form. Sheet beryllium presents a rough, deeply pitted surface to the grinding belt. Experimentation was carried out at Troy on a pinch-roll abrasive-belt grinder. A stream of water at the grinding point washed toxic dust into the filter system. Engineers wore respirators and gloves, and as an added precaution, air pollution checks were made periodically.

To remove pits and inclusions, it was necessary to grind 0.008 to 0.010 in. from the surface. Best results were obtained with a grit sequence of 60, 100 and 150, using X-weight cloth to which the silicon-carbide abrasive was waterproof-bonded with an all-resin adhesive. Rough grinding and polishing were done with a belt speed of 2100 fpm and a work feed of 2 fpm. Multiple passes were required prior to polishing and both sides of the sheet were polished.

Because sheets were brittle and bowed, it was necessary to maintain minimum pressures while grinding. Pinch rolls serving as workholders were operated with no spring pressure whatever. Soft rubber contact rolls and pinch rolls helped to provide required conformity with the work. The material was extracted, cast and rolled by Brush Beryllium Co.

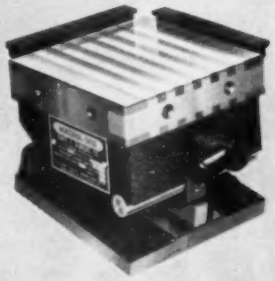
**Process Resurfaces Hot-Rolled Stainless Steel**

Chem-Size, a process which enables less expensive steel to be used for critical aircraft and missile structures, has been developed by Anadite, Inc. Hot-rolled stainless steel, previously considered unusable because of poor surface conditions, is now being resurfaced by the process to eliminate pits and scale and provide aircraft quality tolerances. Under development for over a year and now in production use, the process more than doubles the size of parts which can be fabricated from single pieces of material.

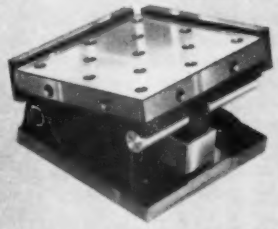
As many as eight pieces of cold-rolled stainless steel have been used to produce a part now obtainable at fractional cost from a single sheet.


**NEW SMALL SIZE**

**LOWER COST, FASTER ACCURATE ANGULAR SET-UP OF SMALL WORK**



Magna-Sine (Model B-3-MS) With 4" x 4" Working Area



Sine Plate (Model B-3-SP) With 4" x 4" Working Area

**ROBBINS MAGNA-SINE**

This new smaller Magna-Sine has all the time-saving, accurate angular set-up features found in larger Robbins Magna-Sines. Small to medium size work can now be set up in minutes instead of hours and with a lower investment in equipment. Magna-Sine table has a strong, fine pole, permanent magnet chuck that firmly holds small work without distortion.

**ROBBINS SINE PLATE**

Robbins small Sine Plate is manufactured to the same high standards of accuracy as the Magna-Sine. This precision makes it ideally suited for angular inspection set-ups. The ground surface of the non-magnetic table has tapped holes for convenient clamping of any work. Also, sturdy construction makes this small Sine Plate extremely suitable for light machining operations.

Compound angles are quickly and easily set up with this Robbins equipment by combining either two Magna-Sines, a Magna-Sine with a Sine Plate, or two Sine Plates. Now, with lower initial investment, every shop can secure accurate angular set-ups for small work. With Robbins equipment, you do a better job, faster and at less cost.

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In keeping with the UNIPUNCH Series "A" Hole Punching and Notching Units this new UNIPUNCH "AJ" Series has the popular "standard" 8⅜" shut height, 3½" die height and the same maximum capacity of ¼" thick mild steel permitting all these Units to be used in the same setups.

All-steel cast holders produce longer life by combining higher tensile strength and longer wear plus greater bearing surface for punch guides than previously available in this type of holder.

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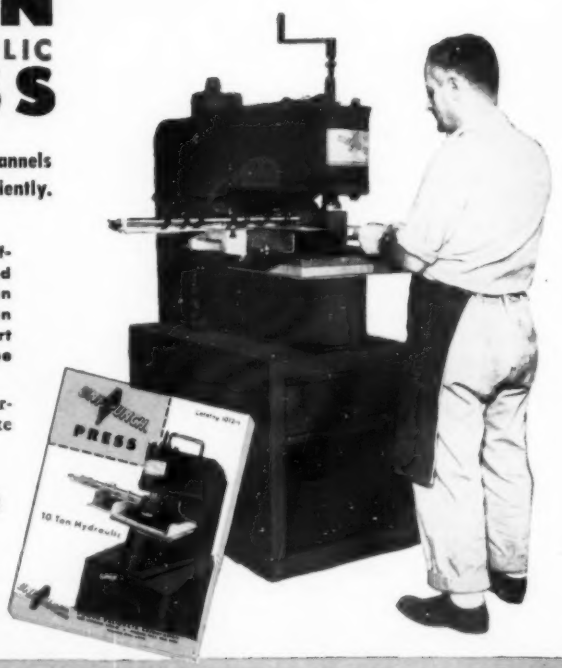


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# Tech Digests

## The Human Relations Challenge of Quality Control

By Glenn Gilman
Coordinator of Professional Education
Lockheed Aircraft Corp.
Marietta, Ga.

How can we make the production worker quality-conscious is a question of motivation. Motivation is a socio-psychological mechanism that "moves" us to satisfy a certain need in one way rather than another, in a fashion that each step toward satisfaction is a meaningful step.

Translating this definition into the quality-control picture, the answer to the question we raised above became quite obvious.

We make the production worker quality-conscious by making quality meaningful to him, a matter of importance, as a part of his progress toward the satisfaction of a basic personal need.

As the basic need concerned, establish "job satisfaction"—which will be taken to mean not only the worker's paycheck, but other less tangible returns he may ask of his job. This might include

1. A sense of security (in the real sense of the word) arising out of his knowledge that he's doing useful work that is adequately recognized
2. A sense of understanding and being understood
3. A sense of self-respect
4. Work that is "interesting"
5. A feeling that he is "part of the team"

Obviously, when these and other satisfactions are lacking or are difficult for him to obtain, his paycheck becomes overwhelming in its importance to him. It has to substitute for all the rest. Perhaps it's not quite so obvious—but when we in management assume that his paycheck is all that maters to the worker, our assumption is quite often "proven" by his behavior. Not because the assumption is basically true—but because simply by virtue of having made it, we frequently fail to provide him with the opportunity to realize other satisfactions!

What can quality control do, both directly and in "backing up" production, toward making quality appear to the worker as a stepping stone rather than a barrier—as a goal in itself, rather than an obstacle to be surmounted on the way toward reaching a primarily economic objective?

Some suggestions follow that are not all-inclusive by any means. Their practicality may vary from one situation to another. But perhaps they will at least point in the right direction—or encourage a look for the right direction in the process of refuting them!

1. Keep quality control in its proper functional perspective.
2. Establish realistic standards for quality.
3. Educate the worker for quality.
4. Train for quality.
5. Maintain rigorous enforcement of reasonable and uniform standards.
6. Get our people "snapped in" on human relations.
7. Let's make the quality control function "authoritative" rather than "authoritarian."

In terms of what we've already said, we need pretty high level people, even in the lowest echelon of quality control. We must use the greatest of care in selecting them and training them. When we're sure they deserve it, let's fight for the highest status that is practicable for them.

The second part of the answer—and the second kind of backing—is to be sure that our quality control supervisors and their inspectors are "teams" in a truly functional sense. I'm referring now not only to the usual kind of relationships that ought to exist between any supervisor and the people in his work group, but as well to the degree of functional integration and reinforcement the quality control supervisor is able to give his inspectors. He must operate not only as an administrator, but as a quality control engineer—does he have the time as well as the training to do what needs to be done in this respect? If the answer is "no", will additional training in administration help him to improve his organization of this phrase of his work sufficiently to free him for the needed time out on the floor?

Based on a paper presented at the Second National Conference, Automotive Div., of the American Society for Quality Control, 50 Church St., New York 7, N. Y.

## Appraising Management Development

By Charles W. V. Meares
Vice President, Personnel
New York Life Insurance Co.

We are learning that development is a dynamic process. Managers develop continuously with or without our help. We know that we need a management development plan to guide all managers toward realizable goals. Should we discover—as we often do—that the manager is on the right track without our help, we should have the good sense not to enroll him in an "improvement" program. We should rather give him the opportunities he needs. Too many managers have to spend too much time seeking opportunities to display their wares. We must seek ways to get the best out of managers in the shortest possible time.

We are slowly learning a most difficult lesson about management development: how to live with our great national passion for standardization and measurement. It permeates every phase of our business life and indeed into our social activities—we can hardly resist the opportunity to keep and compare scores. We have, I think, prematurely attempted to standardize and measure results of management development. Although we seem to be intent on creating a science of management development, I find signs that we are growing more concerned with the end than with the means, whether scientific or not.

The knowledge that the development of managers takes time and patience is growing steadily. Most wise companies are pursuing the legitimate ends of development, resisting the impulse to follow the fads and fashions of the day, and finally overcoming the persuasive voices of the salesmen and apostles of the cure all "one test" programs.

Based on a paper presented at the Mid-Winter Personnel Conference of the American Management Association, Inc., 1515 Broadway, New York 36, N. Y.

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## Involute Splines and Serrations —From a Gaging Standpoint

**By A. S. Beam**

Vinco Corp.
Detroit, Mich.

"If we can measure it, we can make it," is a familiar phrase in tool shops which can be readily reversed to the blunt statement. "If it cannot be measured, discard the design." Or less dramatically, but with just as much validity, "under otherwise equal circumstances, the design which permits more efficient inspection is superior." So stated, it stands as a friendly reminder to the machine designer to consider not only the guideposts of function and feasibility, but also the problems of measurement.

Analytical inspection covers the spacing, the profile, the parallelism, the space width and tooth thickness. Functional inspection probes for the fit with a mating member in the form of a composite spline gage which checks the whole active spline contour.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Space width and tooth thickness are checked either by means of pins or with paddle plug and snap ring gages. These gages are usually the companions of the functional composite gages. This area of inspection occupies, therefore, a middle ground, particularly when functional inspection is addressed as "inspection by spline gages." This alternate division of inspection functions derives merit from the fact that gage inspection is mandatory in production control, while analytical inspection (exclusive of space width and tooth thickness checks) is confined to prototypes, samples, evaluation of rejects, or critical tolerance requirements.

Spacing can be checked either with pins placed in the spline spaces or by indicating directly on the tooth sides. The first method determines the relative position of the center lines of spline spaces; the second, the index positions of the tooth sides, particularly the driving sides.

When checking spacing at the sides of external involute teeth, two methods are available as shown in *Fig.* 1. One method positions the pitch point of the profile approximately level with the spline center and brings the indicating pointer to a stop at the pitch circle, *Fig.* 1a. Readings represent relative displacements at the pitch circle. The other method raises the tooth until the profile normal, at or near the pitch point, is parallel to the movement registered by the indicator, then traverses the pointer over the profile high point, *Fig.* 1b. This method gives readings normal to the tooth. Conversion to pitch-line displacement through division by the cosine of the pressure angle is possible, but yields only 15 percent correction for a 30-deg pressure angle.

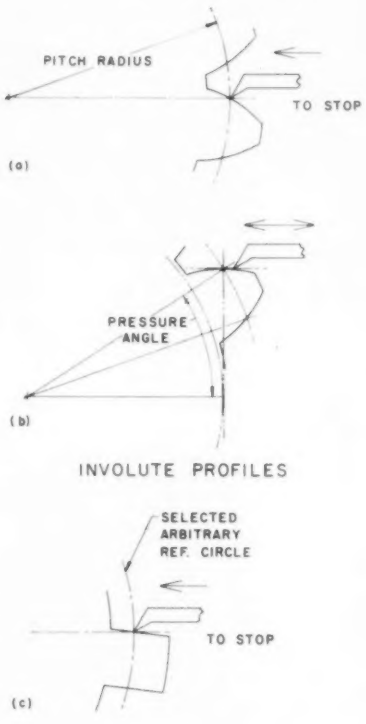



**Fig. 1. Two methods of checking the spacing at the sides of external teeth. (a) Pitch point of the profile is positioned about level with the spline center and an indicator is brought to a stop. (b) Profile normal is raised at or near the pitch point and the indicator is moved over the profile high point. (c) Checking straight-sided spline at reference circle.**

which is usually ignored. The second method is preferred because it avoids jamming of the pointer and needs no stop.

No choice is available when checking the spacing of straight-sided splines or serrations at the tooth sides. The indicator must be brought to a stop at a selected reference circle in order to contact the same profile point of each tooth, *Fig.* 1c.

The involute profile is checked on involute profile checking machines, which are based on the property of the involute that the displacement "D" along the normal is equal to the arc "a" of rotation at the base circle, *Fig.* 2. The profile checking machine times the linear motion of the pointer with the rotation at the base circle. The machine cannot be used for straight-sided splines or serrations unless cumbersome calculations are made for the deviation of the straight side from a hypothetical involute and these deviations do not exceed the range of the indicator.

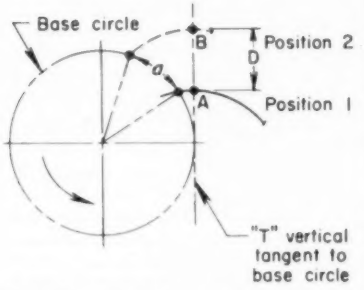
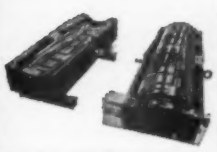



**Fig. 2. Principle of the involute checker.**

Inspection for parallelism of straight-sided splines and serrations employs the same equipment and methods which are used for involute splines and serrations.

The actual space width of internal splines with straight, parallel sides is usually checked by feeler gages since measurements with pins cannot be used. The actual tooth thickness of external splines with straight parallel sides can be measured either by calipers, built-up gage blocks and snap gages, or by means of pins. Both methods of measurement are affected by profile errors. The measurement with pins permits computation of the contact diameter which has little value if the profile condition is not known. Actual space width and actual tooth thickness

TOOL FABRICATORS



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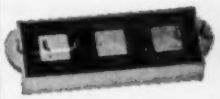

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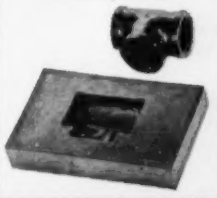

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Based on a paper presented at the Annual Meeting of the Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.


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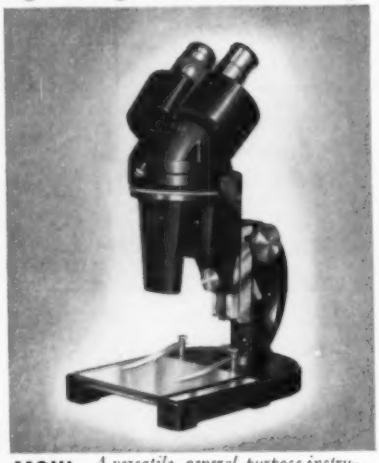

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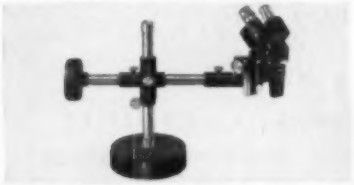

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## Engineering Division Objectives

**By Maurice Nelles**

Vice President, Engineering
Crane Co.
Chicago, Ill.

It is felt that the engineering division can be of maximum usefulness if its objectives are as follows:

1. To provide an organization which can deliberately create products
2. Provide laboratory and prototype manufacturing facilities
3. Maintain an organization for making workable and economic designs and drawings from preliminary designs
4. Provide the knowledge and know-how to minimize costs of making products
5. Develop a skill in estimating
6. Provide a well-tuned organization for designing and ordering special products
7. Provide standards and specifications for materials and equipment which may be purchased by other divisions of the company or for products which may be sold
8. Provide a knowledge of all the codes and specifications which affect the manufacture or use of company products
9. Provide patent coverage for the products of the company
10. Provide a scientific and technical staff which can be used as consultants by other divisions
11. Provide technical information for the entire company
12. Maintain technical relationships with customers
13. Provide an accurate evaluation of products which the company may sell which are not manufactured
14. Provide an authoritative analysis of competitors' products and the method by which they are manufactured
15. An engineering division should not only know the general field in which the company is involved, but should also have an accurate knowledge of allied fields into which the company can diversify, or fields which may develop products which will be competitive with one's own products
16. Provide the know-how on industrial design
17. Provide technical assistance to the manufacturing division
18. Provide evaluation of companies which may be acquired by one's own company
19. Develop a reputation for technical excellence
20. Certainly, one of the objectives of an engineering division should be to manage itself and its own operations in the most business like manner possible
21. Provide a training ground for outstanding young men who can later be transferred to other divisions.

This list, I believe, provides a check list which one can use to see whether an engineering division is covering the scope of activities which it should. Many engineering divisions are in reality sleeping giants and they need only to be awakened, reorganized, stimulated and they will be of extreme use to a company. An engineering division can be either an asset or a liability, depending upon its management.

Based on a paper presented at the Industrial Management Engineering Conference sponsored by Illinois Institute of Technology, Chicago, Ill.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

## Notch Rupture Strength of Type 347 Stainless Steel

By R. J. Christoffel

Materials and Processes Lab.
Large Steam Turbine-Generator Dept.
General Electric Co.
Schenectady, N. Y.

The notch rupture strength of the heat-affected zone in Type 347 weld joints was studied. It was found that in the as-welded condition, the notch rupture strength of the heat-affected zone was seriously impaired. However, the loss in notch rupture strength could be recovered by giving the welded joint a postweld solution heat treatment. The reduction in notch rupture strength was attributed to the mechanical strain produced during welding. It was also considered a contributing factor to the service cracking encountered in some Type 347 weld joints.

Based on a paper presented at the Metals Engineering Conference of The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

## Improved Reliability by Team Effort

By Robert E. Kibele

Chief
Reliability & Design Services
North American Aviation, Inc.
Columbus, Ohio

The following recommendations might be made to a reliability engineer to achieve a better end product through the concept of total team effort.

1. Consider reliability to be a "before the fact" condition, and make it an inherent characteristic of a design
2. Use the tools of experience to achieve improved relative reliability in all phases of design, manufacturing, quality control, and service usage
3. In addition to the usual communications, endeavor always to supply the "reasons why" to all members of the team.

Of these three recommendations, perhaps the third is the most important because unquestionably a high degree of understanding promotes the feeling of belonging to the team. A member of the team, in the know, needs no further incentive to exert his best efforts with real pride.

To achieve improved reliability and to have a total team effort, it will be necessary for reliability engineers to pursue a product from conception to ultimate total consumption. The engineer must look to his own responsibilities first to achieve inherent reliability, and then must emerge entirely from his ivory tower and pursue the product vigorously throughout its life.

Based on a talk presented at the National Aeronautic Meeting of the Society of Automatic Engineers, Inc., 485 Lexington Ave., New York 17.

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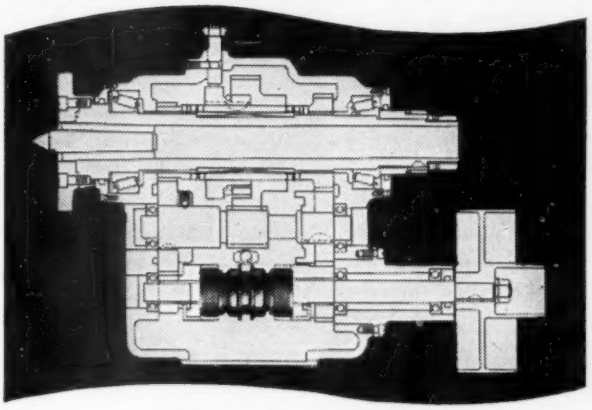

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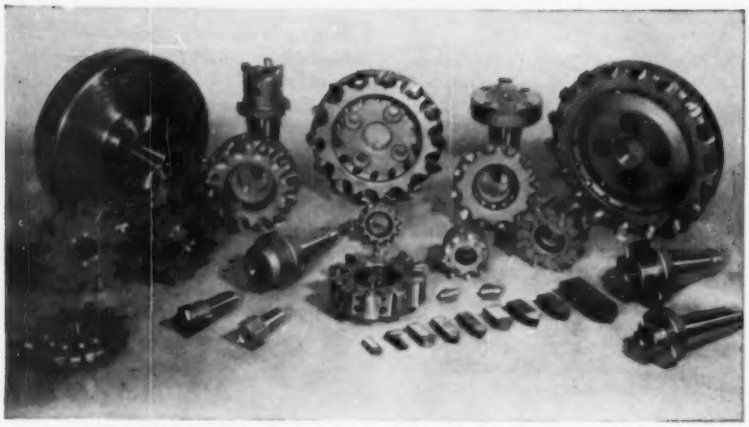

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## Welding Inconel for Nuclear Power

By William F. Fragetta
and
George R. Pease
International Nickel Co.

The present work was undertaken to establish welding procedures and conditions necessary to obtain nuclear quality weldments in an Inconel tubed heat exchanger having an Inconel clad tube sheet. The welding investigation was directed toward three welds of major importance in such an installation: (1) application of a tube-sheet overlay (cladding); (2) tube-to-tube sheet welding; (3) welding of a heaving section transition joint between steels overlaid with Inconel and with stainless steel.

Welding procedures and conditions were established for production of nuclear quality Inconel weldments.

Defect free inconel overlays on A302b steel were obtained with a titanium manganese modified Inconel composition, deposited by the inert-gas-shielded consumable-electrode process. The effects of preheat and interbead temperatures as well as postwelding stress-relief treatments were established in anticipation of code requirements for the A302b steel base metal.

It was established that control of dilution is most closely associated with both welding current and type of equipment used. While the sharp decline in the first weld layer is common to all of three types of equipment employed, the relative amount of decline appears to be directly related to the equipment at a common welding current level.

The welding wire, procedures and conditions established for overlaying were found to be directly applicable for welding the dissimilar overlay transition of heavy section butt welds between steels overlaid with titanium manganese modified Inconel wire and "308" stainless steel.

Reproducibility of metallurgical soundness in tube-to-tube sheet welds has been demonstrated by use of the inert-gas-shielded tungsten-arc process.

Weldability is not affected by the method of tube insertion. Rolled-in tubes were found to be as easily weldable as unrolled tubes in the absence of contamination or moisture.

Based on a paper presented at AWS 40th Annual Meeting and AIEE Electric Welding Conference of the American Welding Society, 33 W. 39th St., New York 18, N. Y.

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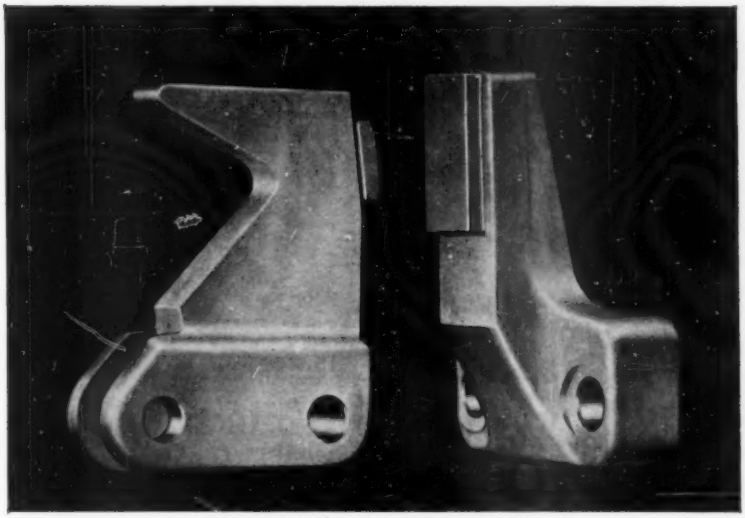
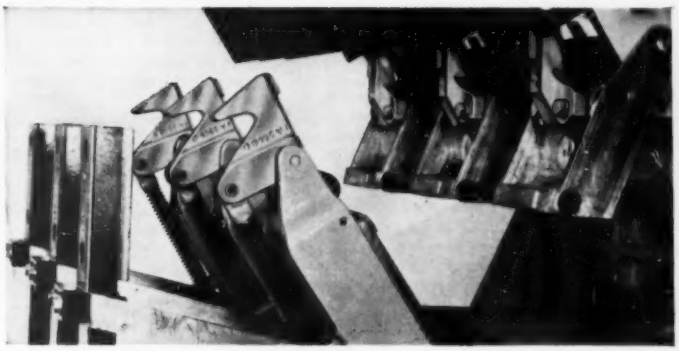
## of die-pressed forgings helps Federal Pacific make new air circuit breakers more rugged—cuts machining costs in half

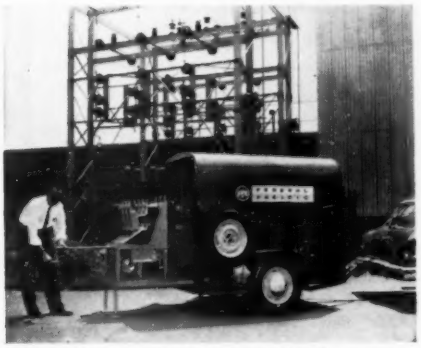


In its new Type DST magnetic air circuit breaker line, Federal Pacific Electric Company, Newark, N. J., builds in dependable operation and long life with parts of outstanding mechanical and adequate electrical properties.

Typical of this attention to detail are the arcing contacts (left). Similar parts previously used had been castings or built-up assemblies. Now the contact bodies are Anaconda Forging Brass-230 die-pressed forgings. The twice-wrought metal is denser, stronger, withstands mechanical shock better—reducing the fatigue factor and producing longer service life. The contacts also have higher conductivity. And best of all, their consistent dimensional accuracy and smooth finish cut machining costs in half.



**RIGHT:** Movable arcing contact assemblies at the left and the stationary arcing contact assemblies at the right in a 5-kv Federal Pacific Type DST air circuit breaker. They have a momentary current-carrying capacity of 60,000 amperes. Contact tips of tungsten alloy are silver-soldered to the forgings. These are two of several areas where Federal Pacific uses the superior physical properties of Anaconda die-pressed forgings to help provide dependable operation and long service life in its line of metal-clad switchgear.



Federal Pacific takes its circuit breakers out to industrial and electric utility customers. Here a representative sets up a demonstration of a 5-kv, 1,200-amp breaker in the field.

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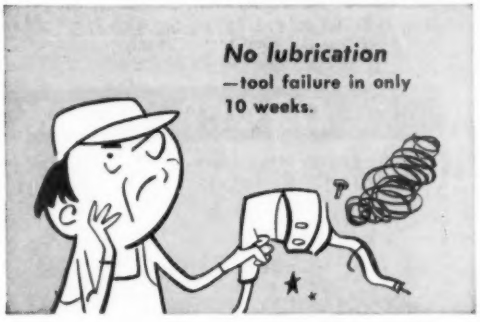

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Enter order for reports indicated by X-marks. Below is order for bulk quantities:

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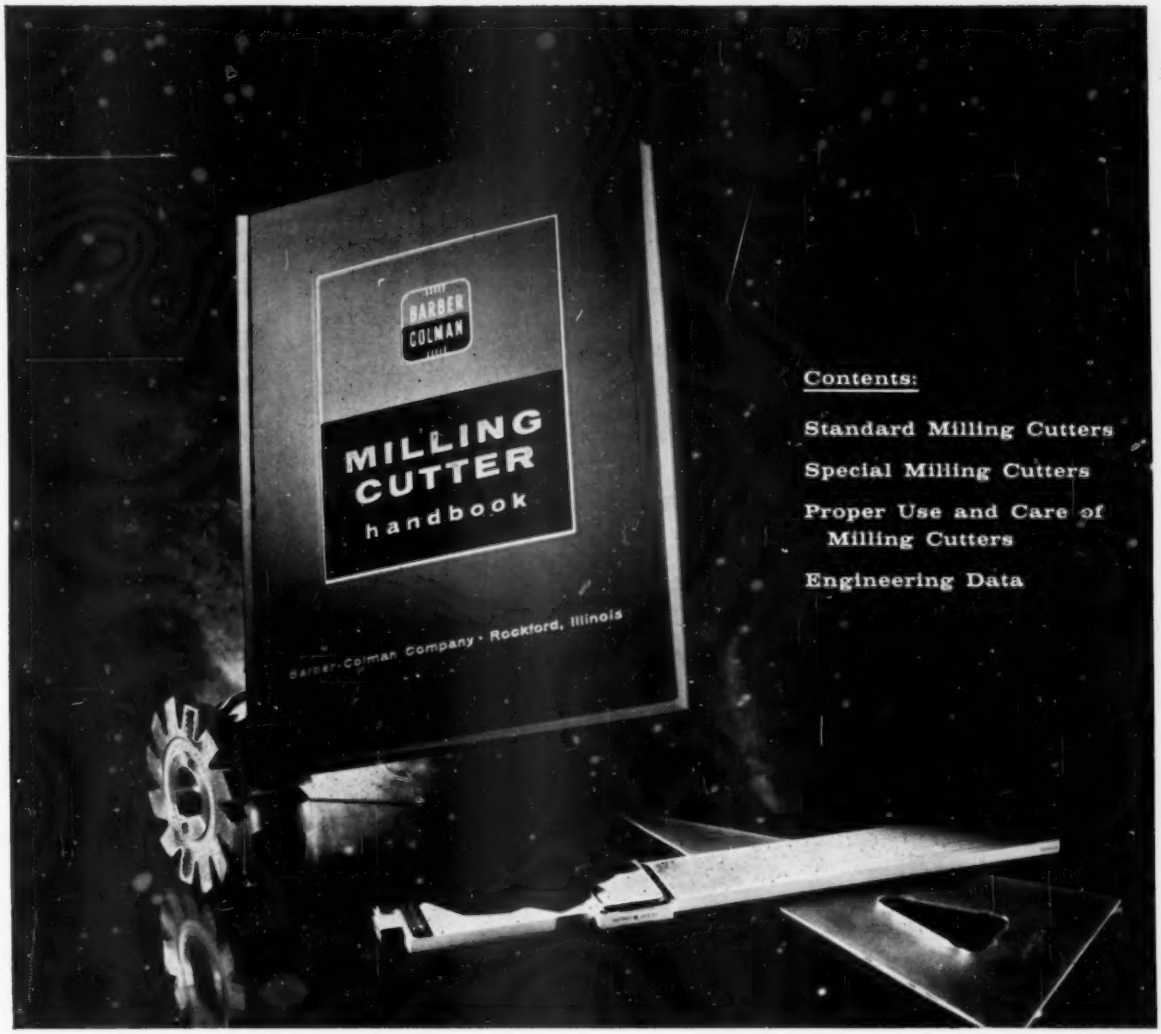
I have enclosed my check, in the amount indicated below, to cover the complete cost of the Research Reports. (Money orders, or Company purchase orders are acceptable. Do not send cash or stamps.)

TOTAL COST $.....

PLEASE CHECK WHETHER OR NOT YOU ARE A MEMBER OF ASTE ☐ MEMBER ☐ Non-Member




# NEW! 220-Page Milling Cutter Handbook

**For tool buyers:** Here, in a single, easy-to-use volume are all the facts you need for selecting and using standard and special milling cutters . . . high-speed steel and carbide-tipped cutters to meet almost any milling requirement you can name.

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Authoritative engineering data completes this comprehensive, one-reference technical handbook . . . available now from your Barber-Colman representative or tool distributor. Call him, or address your inquiry to the factory.

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**123 Loomis Street, Rockford, Illinois**

*Hex socket and Multiple-Spline socket*

## Bristol Dyna-Mites—miniature, No. 0, 1, 2 and 3, button-head and flat-head socket screws

**Here's news for designers of precision equipment—electronic components—missile parts.**

Precision Bristol button-head and flat-head socket screws are now available in smaller standard stock sizes than ever before—down to No. 0, in heat-treated alloy and stainless steel (other metals on special order).

Bristol is the first socket screw manufacturer to offer these tiny button-head and flat-head socket screws, aptly named "Dyna-Mites," as stock items—thanks to increasing demand from manufacturers of a wide variety of precision equipment. Larger sizes (to ¾" for flat-head and ⅝" for button-head) have been standard items with Bristol for many years.

The new button-head and flat-head screws will supplement Bristol's already extensive line of miniature socket cap and set screws in sizes down to No. 0, 1, 2, 3—long a Bristol specialty. They feature the same superior holding power under shock and vibration, can be wrenched up tighter and loosened, time after time, without damage to the socket. And they're made under the same rigid, exhaustive quality-control requirements.

Get complete data on these tiny Bristol Dyna-Mite button-head and flat-head socket screws from your authorized Bristol socket screw distributor, or write to the address below. A-9.4

Precision socket screw manufacturers since 1913
Bristol's Hex Socket Screws
Bristol's Multiple-Spline Socket Screws
*Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap screws up to 1½" diam.
THE BRISTOL COMPANY Socket Screw Division Waterbury 20, Conn.

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## IT FIGURES!

### No. 59 LITTELL COIL WEIGHT AND LENGTH CALCULATOR

It's FREE. It figures accurately. Just set it for the I.D., O.D., Width and Thickness of your coil and it instantly tells you the coil's weight and length. Designed for steel coils. Usable for other metals. Write for your calculator *now*.

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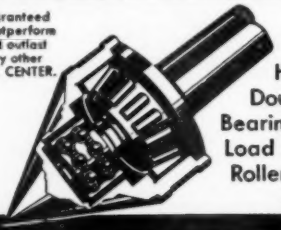
TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 131.

## MARVECO LIVE CENTERS

Guaranteed to outperform and outlast any other LIVE CENTER.



The WHOLE HEAD turns on Double Row Ball Bearings for Radial Load and Tapered Roller Bearings for Thrust Load.

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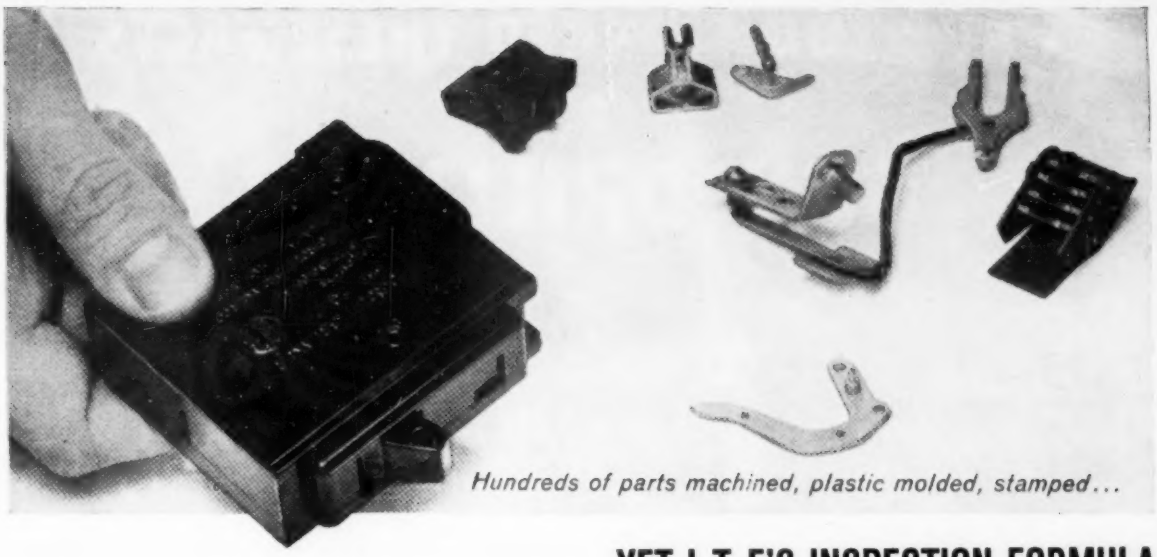

*Hundreds of parts machined, plastic molded, stamped...*

# YET I-T-E'S INSPECTION FORMULA GUARANTEES PRECISION AS PRODUCTION RATES MULTIPLY!

Optical gaging inspects these tiny circuit breaker parts, in some cases seven times faster than hand methods. Permits more thorough, often more accurate, inspection of linear dimensions, hole diameters and locations, radii, angles and contours.

"We've found a practical method to retain precise quality in the many small parts we make to go into our circuit breakers," says the Small Air Circuit Breaker Division of I-T-E, in Philadelphia.

"That method makes *full* use of optical gaging with our Kodak Contour Projectors. They're in constant use to improve our quality and avoid production headaches at the same time.

"Starting in *receiving*, all components from our suppliers are optically checked to save later production snags. Tool and die samples and experimental parts in the *tool room* are optically checked. And finally, we inspect parts right in the *production* line. This way, inspection bottlenecks just don't happen."

Here are just a few reasons why I-T-E and other firms find inspection with a Kodak Contour Projector fast and accurate:

Parts and fixtures are easy to set up, even large parts.

You have a constant 8" of working space regardless of magnification.

You can easily see and check what you're inspecting because there's brilliant, uniform illumination over the entire screen area, and the image is always erect and unreversed—at any magnification you select.

To learn more about these and other features of the Kodak Contour Projector and how they can ease your inspection problems, write for the booklet, "Kodak Contour Projectors."

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# HAVE YOU CHECKED THESE FACTS ON GUN DRILLING?

The Most Economical Gun Drilling Machine on the Market.

Utilizes the Full Potential of Modern Rotating Gun Drills.

Deep, Accurate Holes with Fine Finish (2 to 32 Micro Inches in most materials).

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Ability to Precision Drill Odd Shaped Pieces.

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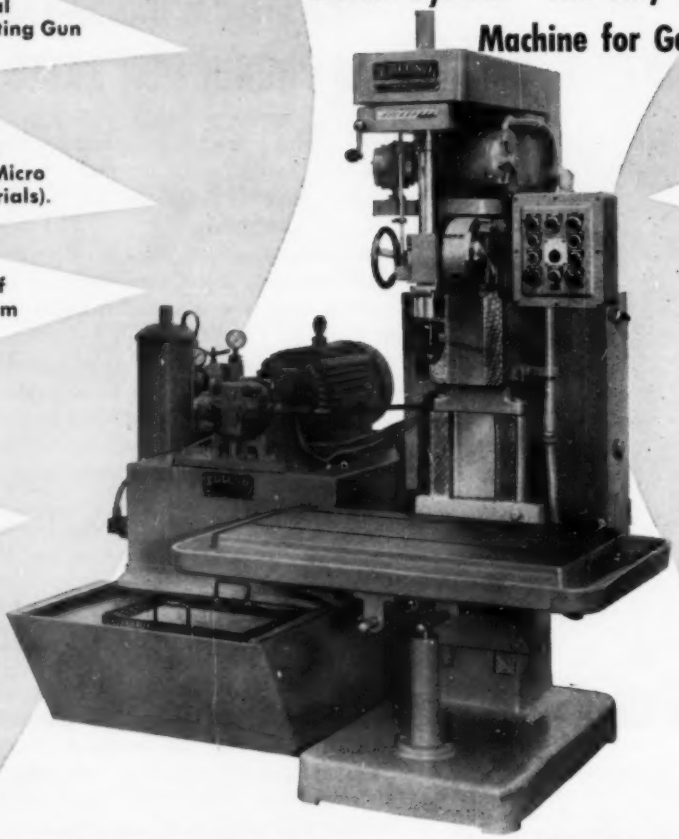
**Gun Drilling Machine Model 2G and High Pressure Coolant System — The only Vertical Gun Drilling Machine for General Purpose Work.**



Accurate Drilling of All Types of Material — Aluminum, Cast Iron, Brass, Tool Steel, Stainless, and other Steels.

Can Eliminate Second Operations — Reaming, Grinding, and Honing.

**Write for descriptive Bulletin 2G or contact the EDLUND Representative in your area for complete information on the Vertical Gun Drilling Machine and Coolant System.**

**SPECIAL CONTRACT JOB WORK FOR GUN DRILLING CAN BE ARRANGED WITH EDLUND. SEND PART, BLUEPRINT AND REQUIREMENTS.**

EDLUND REPRESENTATIVES IN MAJOR CITIES

# EDLUND

**MACHINERY COMPANY** Cortland, New York

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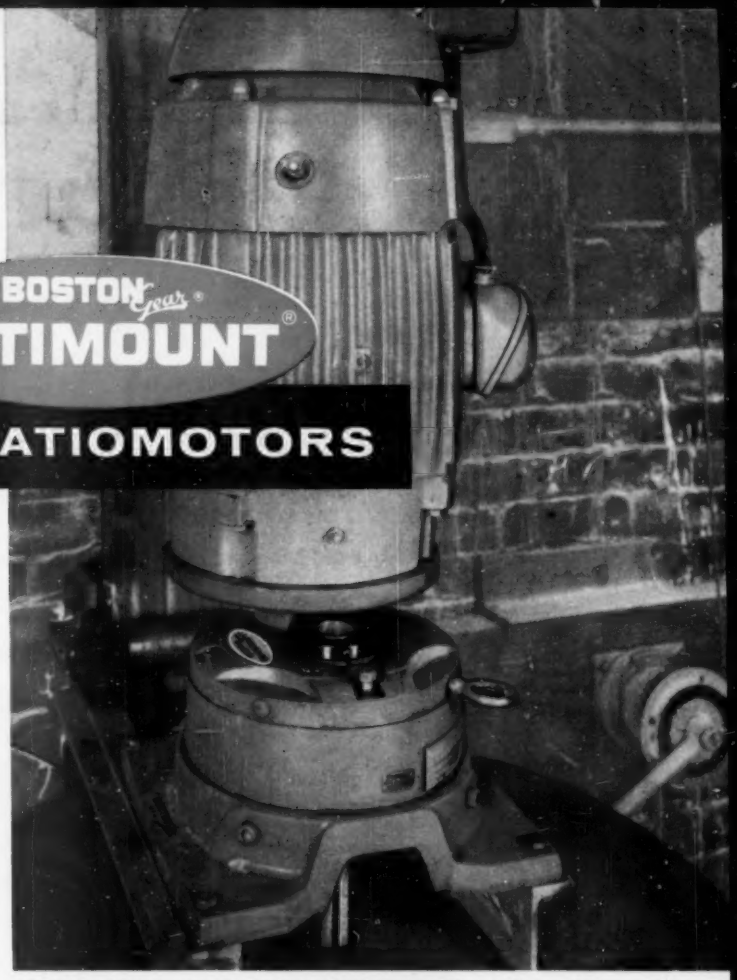
When the job calls for
"~~gearhead motor~~"

# cost-wise designers specify

BOSTON Gear®
OPTIMOUNT®
HELICAL GEARED RATIOMOTORS



## Add up the SAVINGS and see why . . .

**YOU SAVE DESIGN TIME.** Optional mounting gives full scope to your designing skill. Drive arrangements are not restricted by the mounting limitations of conventional gearhead motors.

**YOU ELIMINATE EXTRA COST OF SPECIALS.** With OPTIMOUNT Ratiomotors FROM STOCK, you can meet hundreds of unusual drive conditions that would require "specials" in conventional gearhead motors. You save the delay and extra cost.

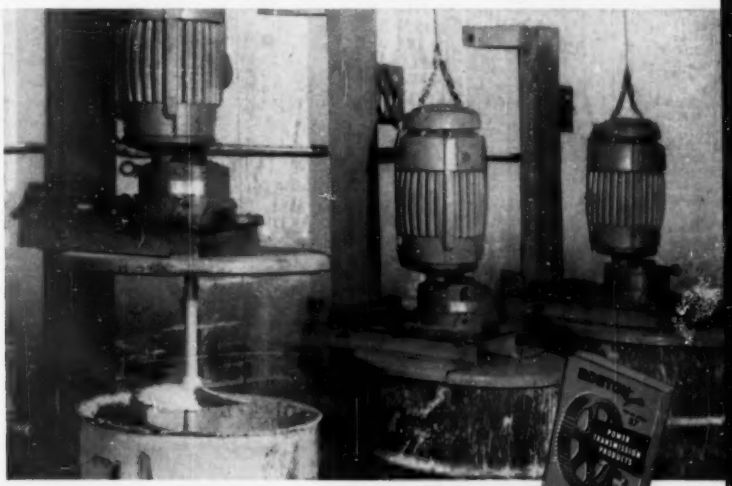
**YOU REDUCE PARTS COST.** Since OPTIMOUNT offers a choice of many output shaft positions, you can design for direct lineup — and eliminate extra couplings, bearings, and other parts needed to "hook up" a conventional gearhead motor.

**YOU SPEED PRODUCTION.** Order the OPTIMOUNT you need with a phone call to your local Distributor, for delivery FROM STOCK. You can start production without delay, maintain schedules, and avoid big inventory expense.

**YOU SIMPLIFY SERVICING.** All OPTIMOUNT components are standardized stock parts — available promptly from over 100 BOSTON Gear Distributors throughout the U. S. and Canada.

Ask your BOSTON Gear Distributor for complete information. Boston Gear Works, 83 Hayward St., Quincy 71, Massachusetts.

**VERTICAL BASE MOUNTED OPTIMOUNT RATIOMOTOR** drives agitator blade shaft on pigment mixers in coated textiles plant. Manufacturer says: "OPTIMOUNT adaptability permitted simplified, efficient design for our specific needs . . . at a much lower cost for the complete installation."



**Meet any in-line drive mounting conditions with STANDARD STOCK models**

**Vertical or horizontal base mounted — for any floor, wall, or ceiling mounting position — choice of many shaft positions in either base — single or double reduction helical gearing — for ⅓ to 10 hp drives. Sold also without motor, ready for attachment of separately purchased motor of your choice.**

*Order from your nearby Distributor and get any arrangement you specify — ready to install*

***FROM STOCK!***
**at factory prices**

**Horizontal base mounted**

**Ask for Catalog No. 57**

**CALL YOUR NEARBY**

**BOSTON Gear® DISTRIBUTOR**

— STANDARDIZATION PAYS —®

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USE READER SERVICE CARD, CIRCLE 72

USE READER SERVICE CARD, CIRCLE 73

# How Ralph Hockett increased diamond wheel life 72%

If ever a man was a perfectionist, that man is Glenn Carr, General Foreman of the Tool Grinding Department at the Wichita Division of the Boeing Airplane Company. And, after fifteen years of working to the kind of tolerances required by the world's leading builder of superbombers, he tends to be skeptical of miraculous claims.

That's why Ralph Hockett of Bay State distributor Wichita Pump & Supply Co., didn't make much fuss about Bay State's new diamond wheels. He analyzed the problem in his usual fact-finding manner, submitted wheels for test and let them speak for themselves.

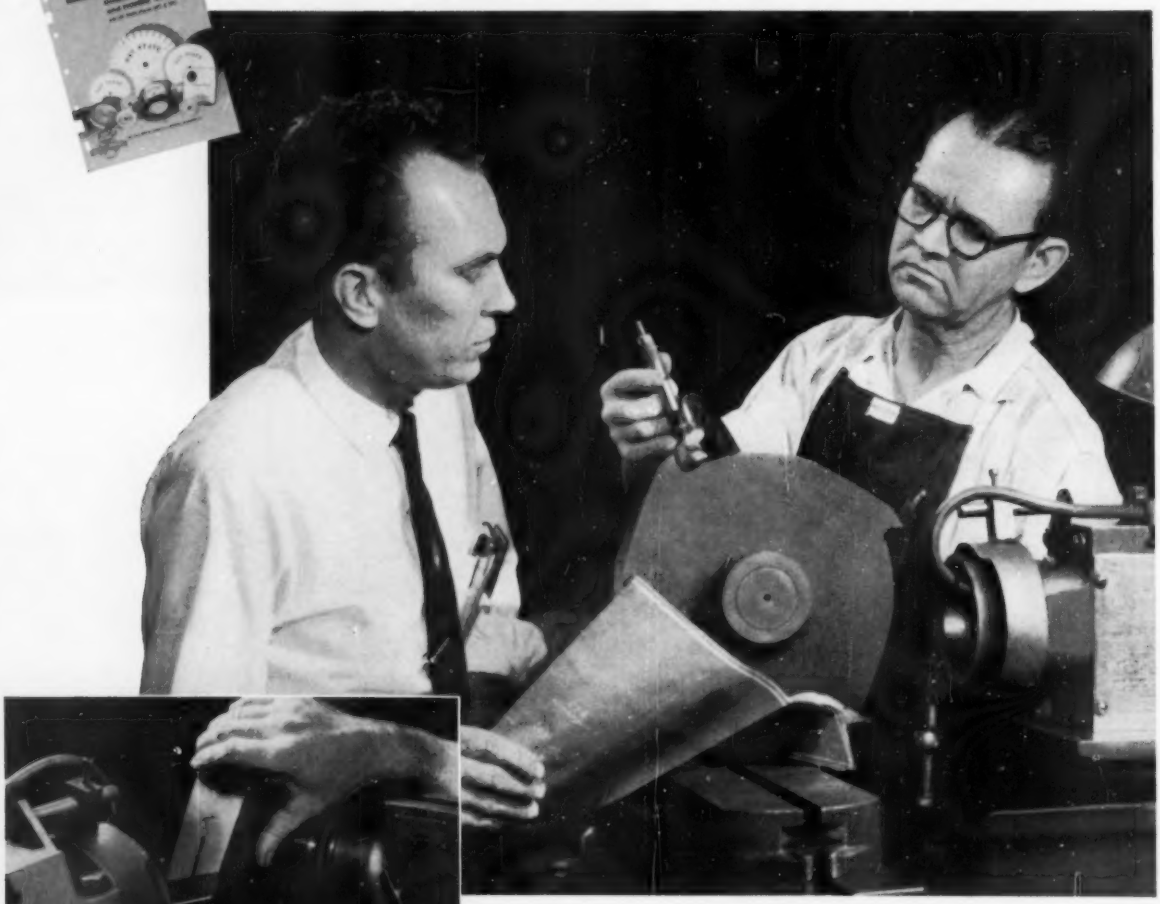
The result was an eye-opener. The pay-off was in wheel life. Against an average life of *125* hours previously, the new Bay State wheels averaged *215* hours per wheel!

One important factor contributing to this bonus wheel life was the use of Bay State's unique BA Resinoid bond.

The Bay State wheels were not only longer-lasting but they were more versatile, cooler cutting and gave a far superior finish. They are now, of course, a regular inventory item at Boeing, Wichita, where B-52 missile bombers are in production for the Air Force.

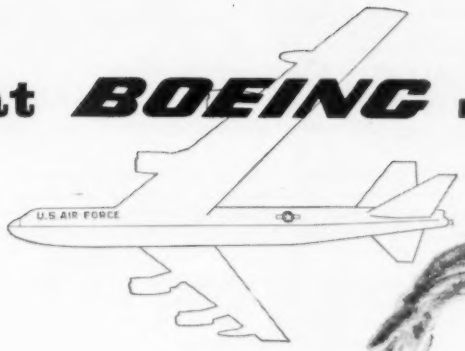
If you have a diamond-wheel grinding problem, you'll find that your Bay State representative, direct or distributor, is ready to supply the right wheel for the job with either natural or man-made diamond abrasive ... and he may well be able to give you a significant improvement in performance, too. Better grinding at lower cost ... that is his business.

This new catalog, which includes pricing data, gladly sent on your request. Ask for Form 217.



Operator Harvey Johnson checks the finish on carbide-inserted tooth of a milling cutter after grinding with Bay State's 215-hour (average life) diamond cup wheel. Glenn Carr, General Foreman, checks Johnson's reading against blueprint.

at **BOEING** WICHITA



You don't get to know the aircraft business overnight and Ralph Hockett is the first to admit that he has never stopped learning. 27 years as an abrasive specialist, with 19 of them servicing Boeing on everything from the early B-17s on up, have given him what you might call a substantial background in the industry.

# BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
*In Canada:* Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
*Branch Offices:* Chicago, Cleveland, Detroit, Pittsburgh, Los Angeles. *Distributors:* All principal cities.



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Leitz 8" OPTICAL COMPARATOR PLUS

GAGE Deep-Etch STANDARD OR SPECIAL CHARTS

COMPARATOR has:

- Vertical light beam
- 3 selective filters
- Indexing lens turret for 10, 20 & 50x
- Retractable Vertical Illuminator
- Circular Protractor screen
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DEEP-ETCH CHART SERVICE MEANS:

- Precision plastic
- Unbreakable
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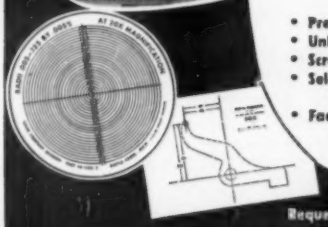
- Facilities for developing Special Charts



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TOOL PLANNERS—5 years experience in tool design and estimating. Will contact vendors. Will be responsible to tool engineer for procurement and successful operation of tools in service. Will prepare cost estimates for tools and manufacture of parts.

PRODUCT ENGINEERS—M. E., E. E., or I. E. with 3-5 years experience. Must have knowledge of capabilities of machine manufacturing processes and economical machine design.

PROCESS ENGINEER—M. E. with 5 years experience in machine tools and processes. Will investigate new manufacturing processes and equipment, prepare recommendations for the purchases of machine tools, and aid in developing tool engineering standards.

Kindly Send Resume and Salary Requirements to:

Fred A. Weterrings, Industrial Relations Division

HALOID XEROX INC.

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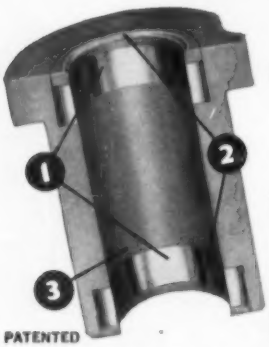
Does the Job of Solid Carbide



PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

...COSTS LESS!

There in a nut shell is the story of MEYCO carbide inserted drill jig bushings! Does everything a solid carbide bushing will do at less cost: lasts almost as long; increases life of drills and jigs; greater accuracy—longer; saves man-hours and machine down-time! All this spells high production at a lower cost. For over a decade, carbide inserted drill jig bushings have been saving money on long production runs for cost conscious customers.

*Write for full details—*
*ask for new Bushing Catalog No.* 42

W. F. MEYERS CO., INC., BEDFORD, IND.

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*Something to look forward to . . .*

ASTE 1960 TOOL SHOW

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- 500 EXHIBITS
- • $15 MILLION WORTH OF EQUIPMENT
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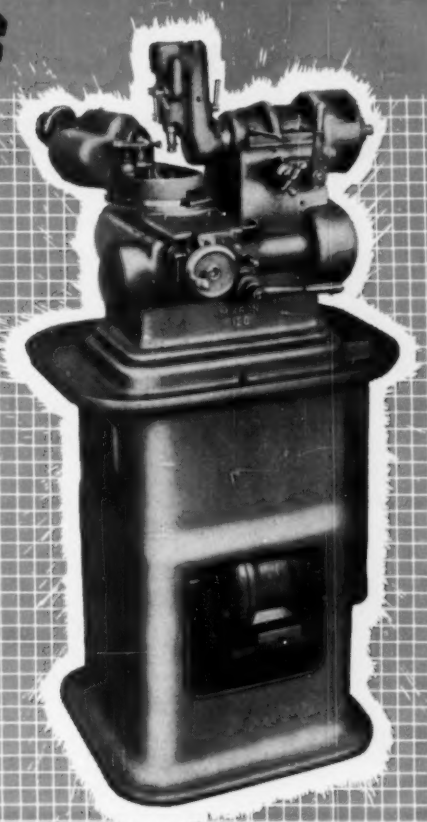
THE ULTIMATE IN

# BEVEL GEAR ACCURACY



• low-cost tooling
• simplicity of set-up

NO. 120 MIKRON

*fine pitch*
BEVEL GEAR HOBBING MACHINE

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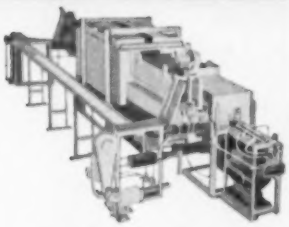
**Wherever industry needs heat...**

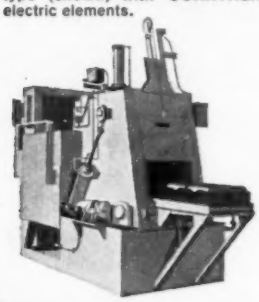
# You'll find *LINDBERG* equipment just right for the specific job

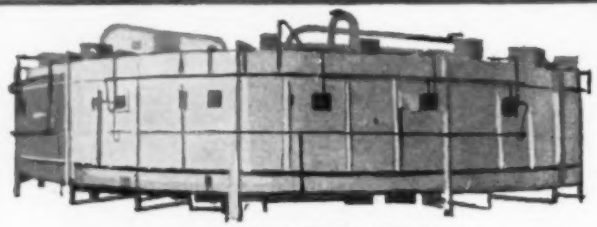


**Ceramic Kilns:** Fully automatic, atmosphere controlled kiln (shown) has 5 control zones for flexibility. Maximum temperature, 2700° F.

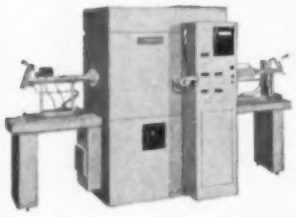
**Roller Hearth Furnaces:** Continuous electric type (shown) with temperature range 1300° to 2100° F.

**Automatic Carbonitriding Furnaces:** Automated integral quench type (shown) with CORRTHERM electric elements.

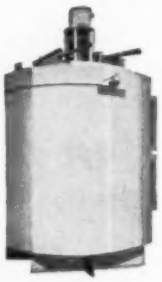




**Rotary Hearth Furnaces:** Doughnut type field-installed gas-fired furnace (shown) with capacity of 13,000 lbs. per hour.

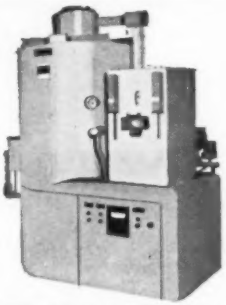


**High Temperature Furnaces:** New Graphite Tube Furnace (shown) with temperature range 2600° F. to 5000° F. for research and production in metal and ceramic fields.



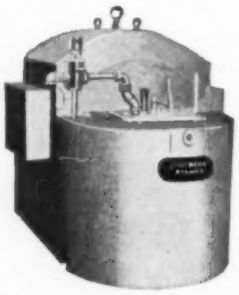
**Vertical Type Furnaces:** Carburizing and hardening furnace (shown) with CORRTHERM electrical heating elements.

**Induction Heating Units:** New Lindberg Floating Zone Scanner for precise production of hyperpure semi-conductor materials and metals and Induction Heating Unit (shown).

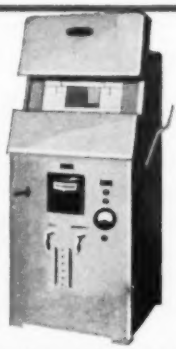


**Atmosphere Generators:** Hyen generator (shown) for endothermic atmospheres. Generators for all required atmospheres.

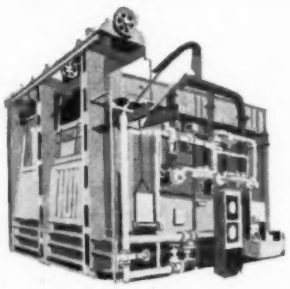
**Cyclone Tempering Furnaces:** Batch type fuel fired tempering furnace (shown). Famous in metal treating industry for years.



**Melting and Holding Furnaces:** Electric resistance furnace (shown) with capacities of 750 lbs. to 1500 lbs.

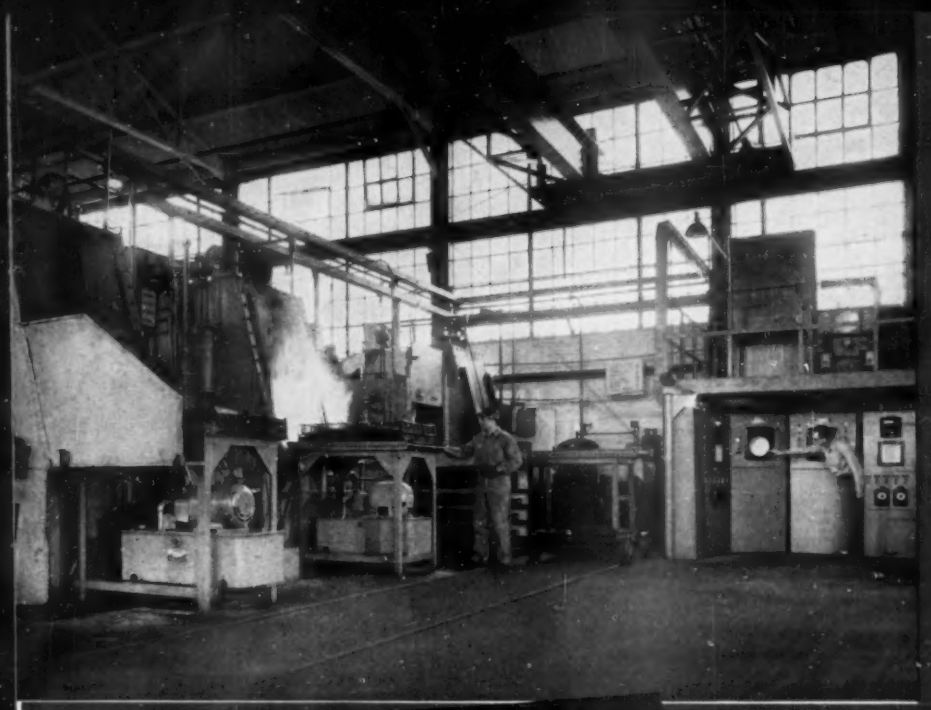


**Laboratory Equipment:** One-unit box furnace (shown), muffle or for non-oxidizing atmosphere with temperature range to 3000° F.



**Aluminum Reverberatory Furnaces:** Twin-chamber melting and holding furnace (shown) with 45,000 lbs. capacity.

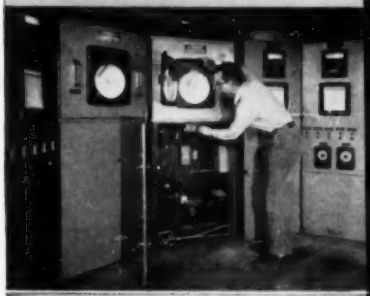
USE READER SERVICE CARD, CIRCLE 80



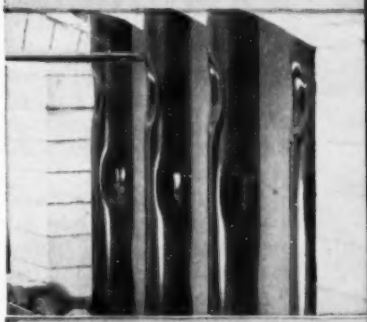
Lindberg-Designed

Charles Hewitt, President of Dayton, says, "The Lindberg installation has kept our production at a consistently high quality level."

Work loads are positioned manually, but entire furnace operation is fully automatic.



Lindberg Carbotrol unit automatically controls and records "dew point" and heating cycles of endothermic atmosphere.



Lindberg's "dimple" vertical radiant tubes give remarkably trouble-free service and function at all times at full efficiency.

# Unique Installation Cuts Heat Treating Costs and Improves Quality at Dayton

Here is a remarkable set-up for general heat treating now in operation at Dayton Forging & Heat Treating Company, Dayton, Ohio. Two integral quench atmosphere furnaces, largest of this type ever built by Lindberg, and one atmosphere tempering furnace in a "three-in-a-row" arrangement that simplifies transfer operation. Combined with Lindberg Carbotrol and Hyen generator, the entire furnace operation is completely automatic, including atmosphere control and recording. Planned by Dayton and Lindberg engineers, the installation runs around the clock, six days a week, reducing costs and producing cleaner end products, brighter job finish, freedom from "decarb" and a consistently higher quality of work.

This is another example of how Lindberg equipment and Lindberg planning can help you find the most effective answer to any problem of applying heat to industry. We cover the field, heat treating, melting and holding, tempering, brazing, enameling furnaces, ceramic kilns, high frequency units, and are in the ideal position to recommend just the type of equipment most suitable for your needs. This can be factory built or field-installed in your own plant, fuel-fired or electric, whatever is best suited to your production processes. Consult your local Lindberg Field Representative (see the classified phone book) or get in touch with us direct. Lindberg Engineering Company, 2447 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 S. Regentview Avenue, at Downey, California.

LINDBERG heat for industry

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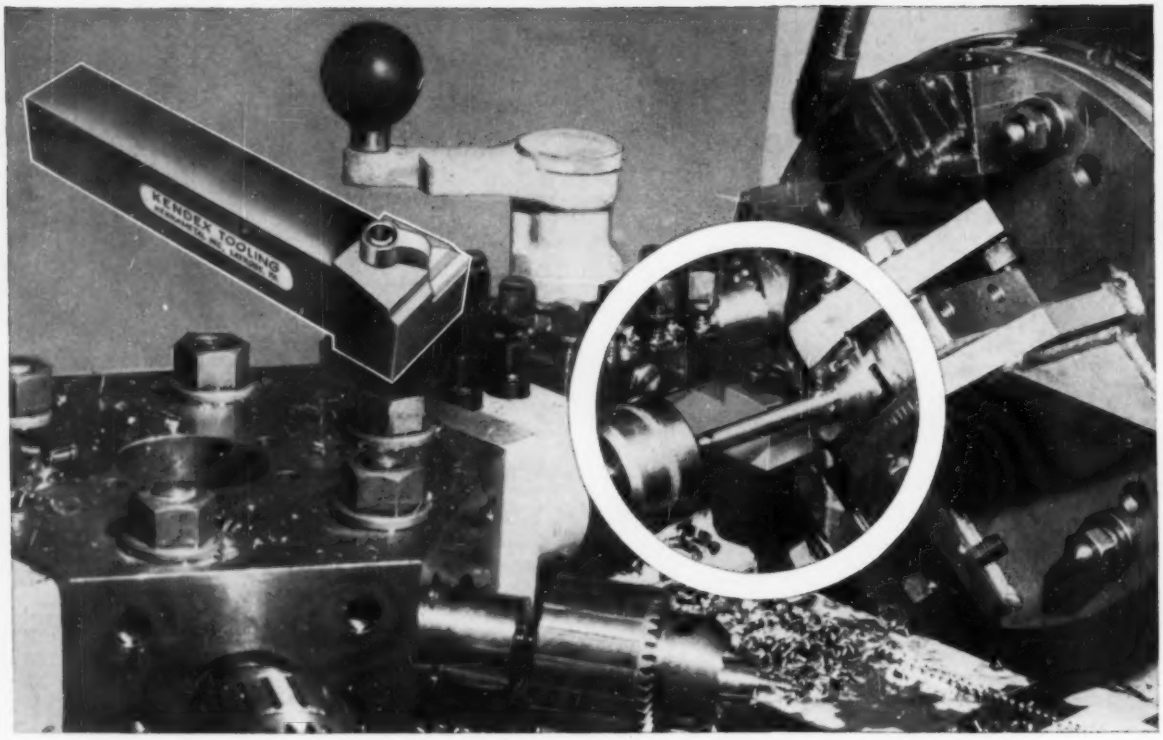


Support bracket for Nike-Hercules guided missile, being machined with Kendex* (patented) tooling from a 316 stainless forging. Photo and performance data supplied by a leading aircraft manufacturer.

# If you could cut machining cost/piece 78% wouldn't you switch to KENDEX?

## That's what happened here

Two turret lathes with high speed steel tools operating on a 10-hour shift could not meet the demands of an assembly line in an aircraft plant. The job involved turning a ½-inch stud and an interrupted facing cut on a forged stainless steel part.

When one lathe was equipped with Kendex (patented) tooling and Kennametal* K8 inserts to utilize maximum output capability of the machine, production was increased fivefold and enough parts were produced by this one machine in 8 hours to keep the line running. The second lathe was released for other work.

*While tooling cost per hour increased over 500%, the machining cost per piece dropped from $3.08 to 68 cents.* By sacrificing a few pennies in higher tool costs, many dollars are being saved in over-all machining costs.

Progressive plants everywhere are using Kendex throw-away insert tooling on production operations and many short-run jobs to obtain highest possible machine efficiency. They have found that "babying" tools to get long tool life is a costly practice.

Ask your Kennametal Carbide Engineer how Kendex can help you get more efficient output from *your* machines . . . or write direct for the booklet, "There's Profit in Retiring a Tradition." KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademark

07288

**Don't waste dollars in machine output to save pennies in tool life**

| | 640-minute tool life | 125-minute tool life |
|---|---|---|
| Machine cost per hour | $ 6.00 | $ 6.00 |
| Tool cost per hour | .16 | .86 |
| Combined cost—8 hours | $49.28 | $54.88 |
| Pieces produced—8 hours | 16 | 80 |
| COST PER PIECE | $ 3.08 | $ .68 |

INDUSTRY AND **KENNAMETAL**

*. . . Partners in Progress*

# New

# SKINNER DUCTILE IRON TROUGH VISES

## are more rigid, stronger . . . and tougher!

● Thanks to the use of a unique new metal, ductile iron, these new Skinner milling machine trough vises have *extra* strength to resist cracking, *extra* toughness to take abuse, *extra* hardness to withstand heavy blows, and *extra* rigidity for extreme accuracy and holding power. They vibrate less, too . . . reducing scrap and tool breakage. You can expect these new Skinner D-I-T vises to hold up longer in service than any other construction and to require a minimum of maintenance.

The holding capacity of these vises is equal to the full width of the jaws. And the precision-machined jaws are rugged enough to hold work under the severest conditions. A flat, smooth body keeps chips from getting under the movable jaw. And a large trough guides the coolant to return — keeps it from slopping over. A square lock construction provides additional rigidity.

Jaw widths: 4″, 5″, 6″, 7″, 8″. Optional swivel base for setting vise at any angle through 360° in a horizontal plane.

**Skinner Vises and Chucks are available nationally from leading Industrial Distributors, Machine Tool Builders and Dealers. For complete information, contact a Skinner Representative or write us at Dept. 18D.**

SKINNER CHUCK®

THE CREST OF QUALITY

# SKINNER VISES

THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT



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DOW | METAL PRODUCTS

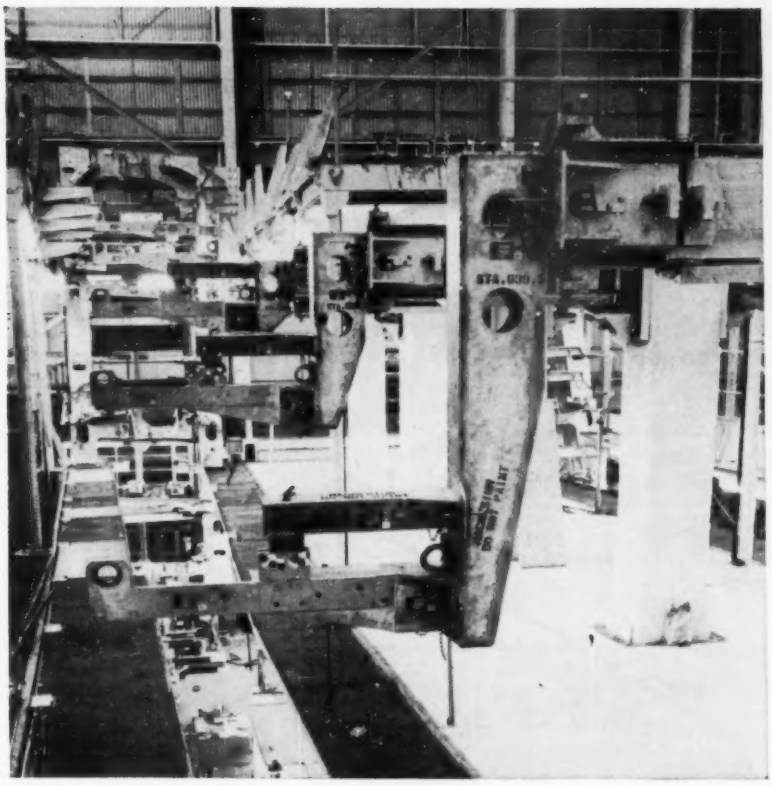
NEW BOEING 707 is first JET to fly in commercial service in the U. S. Extensive use is made of magnesium tooling plate in building the 707.

# LIGHTER, FLATTER MAGNESIUM TOOLING PLATE

## helps build new jet airliner

**The use of magnesium tooling plate increases rapidly as more and more plants discover its important benefits. Weight savings, precision flatness, fast machining and dimensional stability are reasons for its use in many applications. Take Boeing, for example . . .**

Magnesium tooling plate and extruded channels are in widespread use at Boeing's Renton, Washington, plant where the new 707 jet airliner is manufactured. Welded magnesium plate and channel are used as parts for an overhanging wing jig (see photo). Because of magnesium's lightness, such locators can be long and yet be rigid. Furthermore this lightness results in a less



severe load on the basic structure permitting it also to be lighter and less expensive. Other magnesium jigs which can be positioned and put in place by hand can easily be positioned without mechanical equipment. If made of steel, a sizable working party or a crane would be needed each time they were moved.

The top of a 20′ x 20′ master template table at Boeing was constructed of two thicknesses of 1½″ magnesium plate. No machining was required on the plates, permitting a substantial cost savings over a previous master template table made of steel plate, which required considerable machining. The stability of magnesium has maintained the necessary tolerances during use. A large 707 door locating jig also made of magnesium tooling plate can be handled by two men, and can be easily stored when not in use. The stability of welded magnesium structures in this and other applications is invaluable for large assembly jigs.

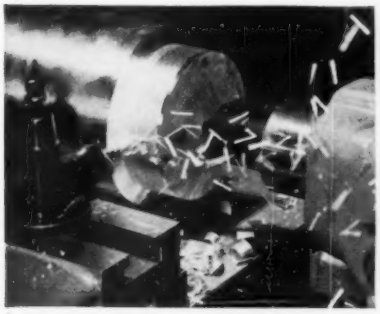
* * *

The lightness, flatness, stability and stiffness of magnesium tooling plate have likewise greatly increased its use as a base plate for plaster forms.

There are other advantages that make lightweight magnesium desirable as tooling plate material: Manually positioned welding jigs are easier to handle, weld spatter doesn't stick, high heat conductivity prevents warping from local heating, and nonmagnetic magnesium used for spot welding jigs causes no interference. Wherever magnesium tooling plate is used, it means less frequent use of lift trucks and other power handling equipment.

* * *

**NEW MAGNESIUM TOOLING PLATE MANUAL. This handy, fact-filled reference book covers shop working characteristics, properties, design, etc., for magnesium tooling plate and tubing. For your copy, contact any Dow sales office or write THE DOW METAL PRODUCTS COMPANY, Sales Department 1339FJ12, Midland, Michigan.**



**MACHINING TIME CUT TO SHREDS**

**Drilling, milling, reaming, sawing and other machining operations can be performed on magnesium with surprising economy. Magnesium machines faster and easier, reducing production time and tool wear to a minimum.**

**LONG SUIT: WELD STRENGTH**

**Magnesium tooling plate is easily joined by inert gas arc welding. High strength welds and joint efficiencies up to 95% are common. Any joint commonly welded with steel can be welded with magnesium, allowing exceptional versatility for tooling jobs. Magnesium can also be joined by common methods of mechanical fastening.**

**MAGNESIUM TOOLING PLATE IS AVAILABLE FROM STOCK AT:**

**E. F. Bailey Company**
Seattle, Washington

**Clendenin Bros., Inc.**
Baltimore, Maryland

**Copper and Brass Sales, Inc.**
Cleveland, Ohio; Detroit 12, Michigan

**Fullerton Steel and Wire Company**
Chicago 35, Illinois

**Hubbell Metals Inc.**
St. Louis 3, Mo.; Kansas City, Mo.; Marietta, Ga.

**A. R. Purdy Co., Inc.**
Lyndhurst, New Jersey

**Reliance Magnesium Company**
Los Angeles 58, California

**Joseph T. Ryerson & Son, Inc.**
Dallas, Texas

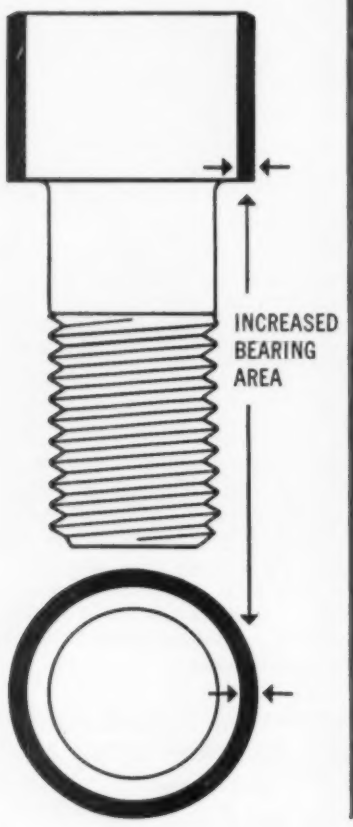
**THE DOW METAL PRODUCTS COMPANY, Midland, Michigan**

DIVISION OF THE DOW CHEMICAL COMPANY

# A MAJOR DEVELOPMENT IN SOCKET CAP SCREW DESIGN!

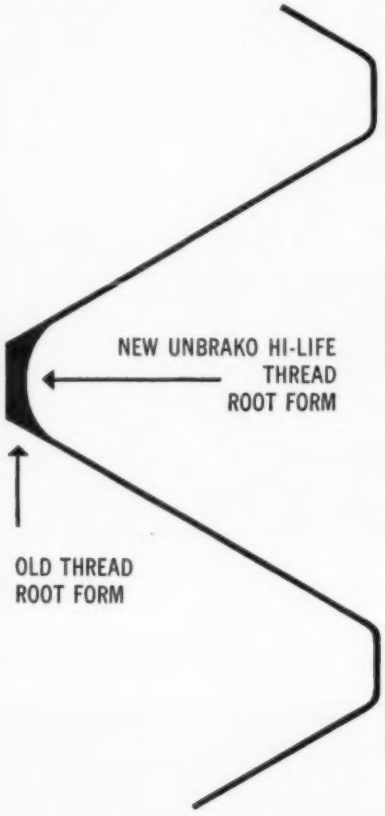
## UNBRAKO *pHd** with Hi-Life thread— the advanced fastener for the 60's

**Stronger in the head**




UNBRAKO pHd design features increased bearing area under the head, bigger wrenching socket; provides up to 2½ times as much holding power without indenting bolted material. By permitting higher preloading, pHd helps eliminate fatigue failures, reduces possibility of screws working loose under shock and vibration.

**Stronger in the thread**

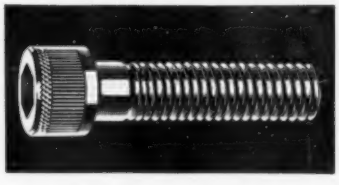



New UNBRAKO Hi-Life thread form has smoothly radiused root, slightly more metal at minimum cross section. Result: up to 100% greater fatigue life, plus a bonus in added tensile strength. Only UNBRAKO gives you the new, larger pHd head design and the improved Hi-Life thread . . . in a standard screw at no extra cost.

Anticipating tomorrow's demands today, SPS now offers you a standard socket head cap screw that incorporates both the UNBRAKO pHd design (1960 Series) *and* the new UNBRAKO Hi-Life thread.

This combination gives you a fastener that is unequaled in strength and performance. Because of its increased bearing area and bigger socket, you can tighten it tighter without deforming screw or bolted material. Thus you get more holding power—up to 2½ times as much, in fact. And because of both increased bearing area *and* new radiused thread root, the UNBRAKO pHd Hi-Life is almost twice as strong in fatigue.

The pHd head and Hi-Life thread —both originated by SPS—are tangible results of a continuing program of basic research in the design and performance of threaded fasteners. And they reflect to no little degree SPS experience in developing special high-strength fasteners for aircraft/missile use. Nevertheless, this new UNBRAKO is available to you as a standard—at no increase in price. For complete data, write SPS—manufacturer of precision threaded fasteners and allied products in many metals, including titanium.



New UNBRAKO pHd socket head cap screws with Hi-Life thread are available now from your authorized industrial distributor in standard sizes ¼ through 1 inch, plain or cadmium plated. Available also with the Nylok† self-locking feature. NOTE: UNBRAKO pHd Hi-Life screws fit standard tapped holes, require no special gaging.

†T.M. Reg. U.S. Pat. Off., The Nylok Corporation

**INDUSTRIAL FASTENER Division**

JENKINTOWN 37, PENNSYLVANIA

SPS

*pHd stands for "proper head design"—a factor in higher product reliability

New life for old lathes with:

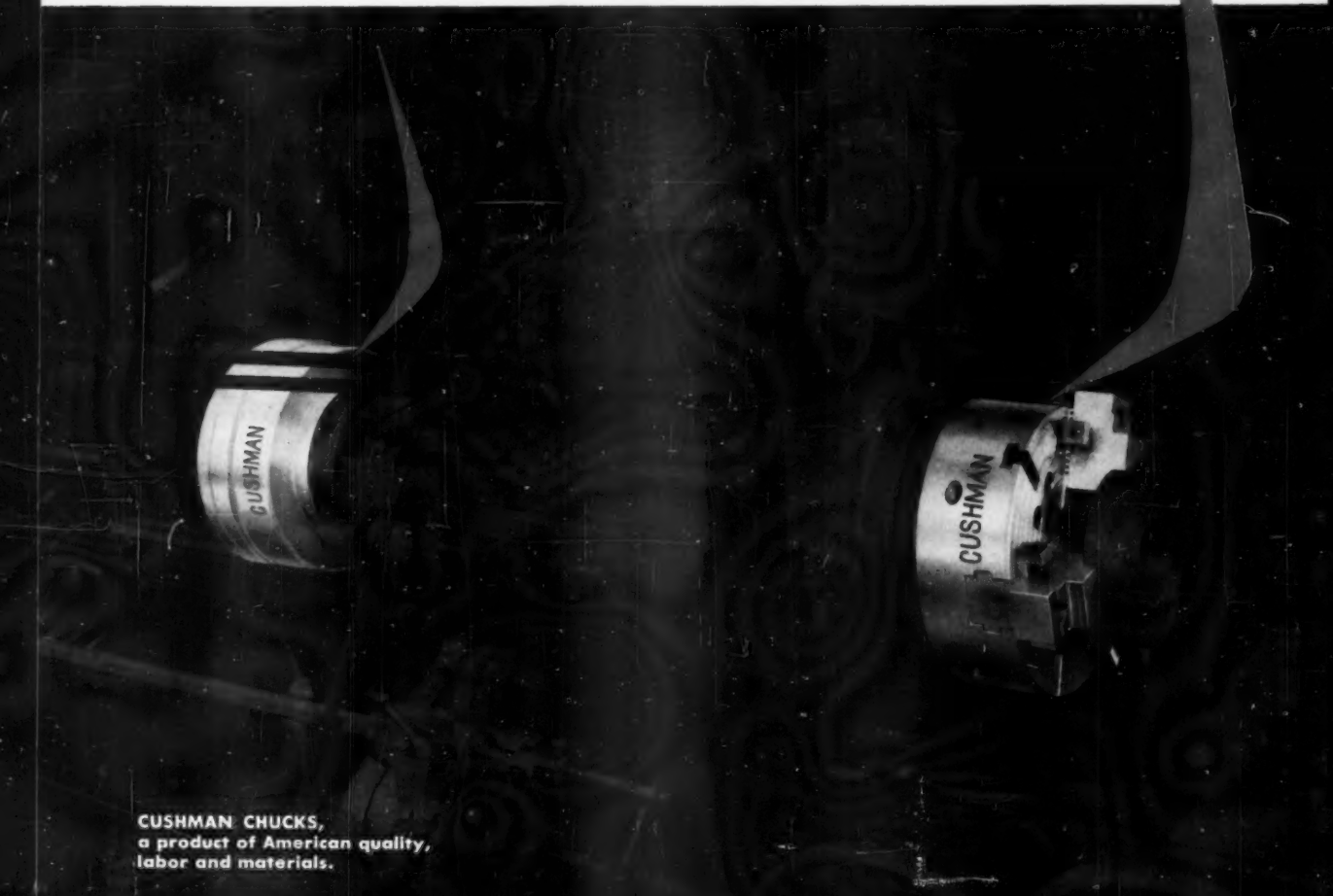
# Cushman air operated

## CHUCKING EQUIPMENT

Cushman, the leading manufacturer of air operated chucking equipment, offers a complete line of air operated chucks, cylinders, and accessory equipment which enable your quality-built older lathes to continue in competitive productivity.

Cushman Air Operated Chucks and Cylinders are engineered to meet the requirements of heavier feeds at higher speeds, maintain repetitive precision accuracy and positive gripping with truly fast workpiece chucking and unchucking.

Write today for your copy of Bulletin PO-65D and see how you can effectively extend the productive life of your older equipment by adding efficient, economical Cushman Air Operated Chucking Equipment.

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labor and materials.

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# NEW

## Gardner-Denver "Airfeedrill"® with "aircheck" feed control

### *Check these "aircheck" features*

- ✓ Low initial investment . . . simple to maintain . . . economical to use
- ✓ In-line hose arrangement
- ✓ High-speed feed with slow break-through for clean holes
- ✓ Closer center-to-center mounting
- ✓ Short over-all length
- ✓ Develops full ⅓ hp

# NOW

## simple, easy, low-cost automation of many drilling setups

Now it's easy and inexpensive to automate drilling such materials as plastics, wood, aluminum, steel, cast iron and sheet metal. Engineer an automatic drilling setup with new Gardner-Denver "Airfeedrills" with "aircheck" feed control.

These versatile new drills are easily adaptable to almost any drilling setup. You mount them as a drilling unit of two, 20 or more spindles for automatic hole processing. Use one as a stationary drill mounted on an inexpensive fixture. As a portable drill, "Airfeedrill" hangs by its nose to a jig for precision drilling.

See for yourself how quickly and inexpensively you can automate *your* drilling operations . . . see your Gardner-Denver representative or write for Bulletin 92-121.

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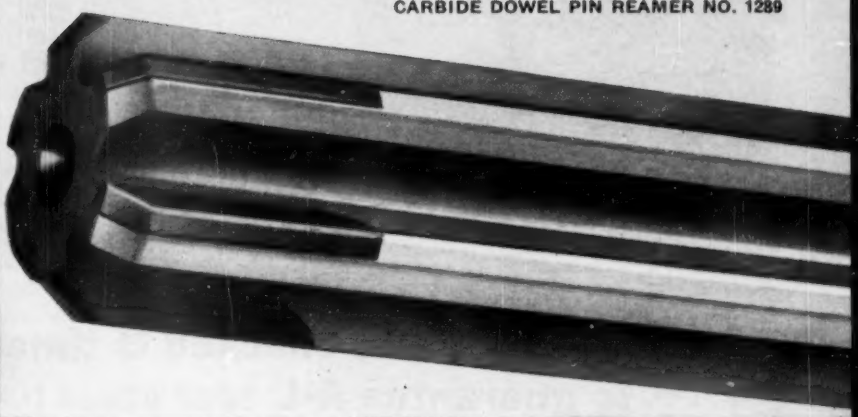
CARBIDE DIE DRILL NO. 1500

# Reduce Tip Failures with W & B Perma-Braze Carbide Tools

CARBIDE DOWEL PIN REAMER NO. 1289



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Perma-Braze is an advanced process pioneered and perfected by Whitman & Barnes that enables carbide tips to be brazed with a specially developed high temperature alloy at the same time the high speed bodies are hardened. The result is uniform body hardness and carbide tips that will not loosen due to braze melting. Your payoff is greatly reduced tip failures . . . less machine down-time . . . longer tool life. You get lower tooling costs *and* a more efficient operation. Ask your W&B distributor about Perma-Braze carbide tools today!

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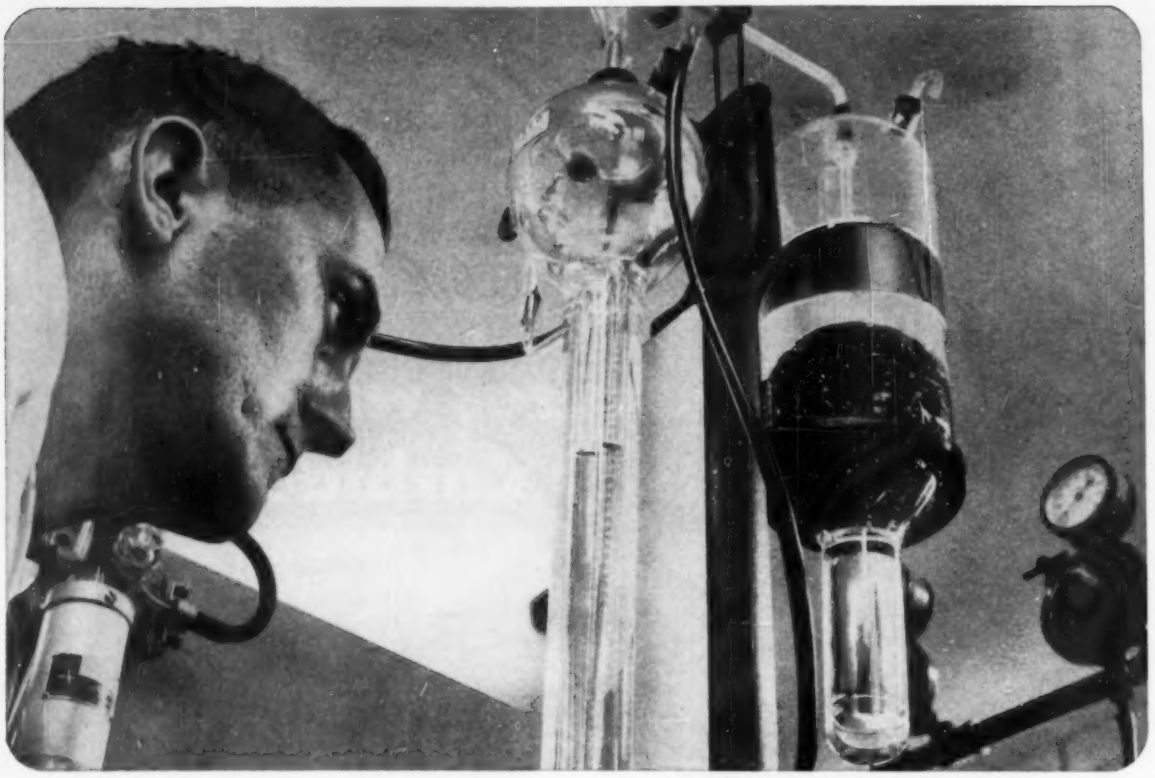
***Experience**—the added alloy in **Allegheny Ludlum** tool steels*



QUICK, FAST TESTING for carbon content is done not once or twice but 8 times per melt in A-L's Chem Lab with this direct reading Leco carbon determinator.

# Carbon content checked 8 times during melt to guarantee A-L tool steel hardenability

**Lab tests for carbon eliminate your guesswork; provide high hardness, uniform hardenability, reproducible tool performance.**

Because carbon has the greatest influence on hardenability, Allegheny Ludlum watches it carefully during the melt. Testing a specimen for carbon takes only a few minutes. Therefore, A-L checks for carbon content 8 times during the melt, and makes the necessary adjustments to insure accurate control of carbon. This control means Allegheny Ludlum can hold carbon content to a closer range than most customers specify.

Carbon control at Allegheny Ludlum assures you of precise response to heat treating. This control in the melt brings you predictable, *high hardness, uniform hardenability* and *reproducible tool performance.*

This is just one of the many things A-L does to insure high quality. Here are some others: close control over forging techniques, rigid temperature-time programming, careful testing of billets prior to processing to insure good surface and sound interior, control over annealing to give you the right hardness for your exact machining operation, thorough metallurgical testing to insure top tool steel quality and meeting of your specifications.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

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every grade of tool steel... every help in using it

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*with the Original Mead*

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*(Spring Return Air Cylinder)*

***In assembly jigs and other multiple applications, this new, low cost pressure unit saves countless man-hours. As a work-ejector in many fixtures, it is unexcelled.***

## Advantages over mechanical clamps

1 **All Air Clamps** in any set-up can be operated by a single master valve—the "lock-up" and release of assemblies is instantaneous.

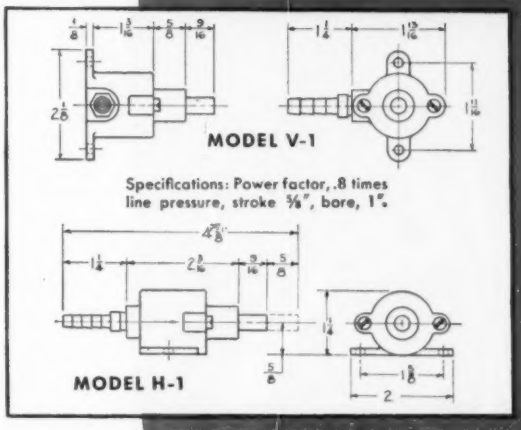
2 **May be installed in cramped corners** difficult to reach with bulky mechanical clamps. Mead Midget is the most compact air cylinder, for its power, on the market.

3 **Equal ram pressure at any point** along stroke, making special, delicate adjustments unnecessary.

4 **Independent group control.** Any desired group of "Midgets" can be controlled independently of any other group in an assembly—as where primary members of the fixture must be locked up before the secondary members.

5 **Facilitates delicate drill operations.** Air Clamps actuated by foot control valves leave operator's hands free to handle the work pieces.

*Send for all the interesting facts on these time-tested, superior Midget Air Clamps.*

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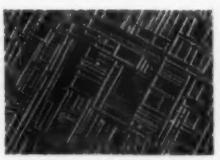
# The revealing face of an iron crystal

A single crystal is an ideal system for studying the solid state. Physicists at the General Motors Research Laboratories have turned to whisker-like growths of nearly perfect single iron crystals to investigate three intriguing phenomena: magnetic domains, dislocation defects, and—more recently—high temperature oxidation.

In this latest study, the two crystallographically different surfaces found on iron whiskers are being used to examine the anisotropy or axial-dependent nature of the oxidation process. In early stages of oxidation, the oxide patterns that form on clean surfaces have been found to be strongly dependent upon the orientation of the underlying crystal. In later stages of oxidation, tiny oxide "cilia" actually grow on the surface of the iron whisker. But these new whiskery forms of oxidation are no longer related to the crystal's surface arrangement. The next step in this program involves correlating the oxidation behavior with lattice structure defects such as vacancies and dislocations.

This type of solid state research is revealing the atomic processes underlying strength, magnetic characteristics, and corrosion resistance of metals. At GM Research, we believe the solution to practical problems is increasingly dependent on fundamental information such as this. And each solution enables us to continue to provide "More and better things for more people."

GENERAL MOTORS RESEARCH LABORATORIES



Early Oxidation
(750x)

Oxide Whiskers
(12,000x)

Reduction of Oxide Products
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## Cut costs here

## Free-machining DESEGATIZED® HIGH ALLOY DIE STEELS

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*grades regularly stocked for long-run die applications...*

- **OLYMPIC FM** (Type D-2)
  ... for typical long-run applications
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  ... for extreme abrasive service
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Latrobe's 12% chromium die steels are easier to work, easier to machine . . . because they contain evenly-dispersed, fine alloy sulphides which permit faster speeds and feeds, and result in better machined surfaces.

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Let us quote on your special punch requirements.

**10 SPEED TURRET DRILL HEAD**—SAVE FROM 40% to 60% MACHINING TIME. Fits any single spindle vertical drill press or miller. Drills 2 to 7 holes . . . taps 2 to 7 sizes in one set-up.

**QUICK SET UP TOOL ROOM SHAPER**—completely equipped—all set-ups take less than 5 minutes.

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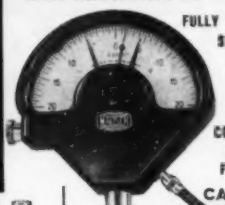
- DIAL GRADUATIONS 20-0-20



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**Semi-Standard Heavy Duty Full Ball Bearing**

½" in Cast Iron—7⅛" or 9¾" Dia.

½" in Steel—7" or 9⅝" Dia.

Also larger Adaptations and Full Line of Fixed Center Drill Heads.

* Standard Full Ball Bearing Construction including Spindles. Driving Assembly is FULL BALL BEARING mounted with 3 Bearings on each spindle. Thrust load carried by radial thrust bearings.

* Standard Slip-On and Slip-Off Template Construction. For accurate setting and locating spindle brackets are machined to receive slip-on and slip-off template.

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A SUBSIDIARY OF THOMSON INDUSTRIES, INC.

Also Makers of DORMAN AUTOMATIC REVERSE TAPPERS

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# COLUMBIA TOOL STEELS

**For over fifty years COLUMBIA has built its reputation on tool steel that is *good* for you**

Product of Skilled American Workmen

COLUMBIA TOOL STEEL COMPANY
450 Lincoln Highway
Chicago Heights, Illinois

TOOL COLUMBIA STEELS

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1½ times actual size

# 220 MILLION PIECES

## FROM THIS 12-STATION TOOL STEEL DIE

Photo courtesy of Werner Die & Stamping Co., Cary, Illinois, makers of this die.

Tolerances on the intricate shaft-mounted spring shown here are plus .003", minus .000" . . . no burrs allowed . . . and stamping speed is better than 240 a minute. This calls for die-making precision—and a precision die set.

Reliable, consistent precision of the Danly Die Set provides the closure accuracy necessary to the performance of this fine die. After this unusually long run of a precision stamping in a tool steel die, the die set is in good condition.

Danly production methods consistently maintain the highest standards of die set precision through individual control of every critical dimension. Thousands of fine tool and die shops agree that the finest die set obtainable is usually the lowest cost insurance on any die-making investment. Find out how Danly precision can save money for you.

Write for new folder on
**"The Importance of Die Set Precision"**
Lists and discusses all critical dimensions . . . shows how and why consistent Die Set precision is vital in every die-making operation.
Send for a free copy.

*Branches and Distributor Assembly Plants in all Toolmaking Centers*

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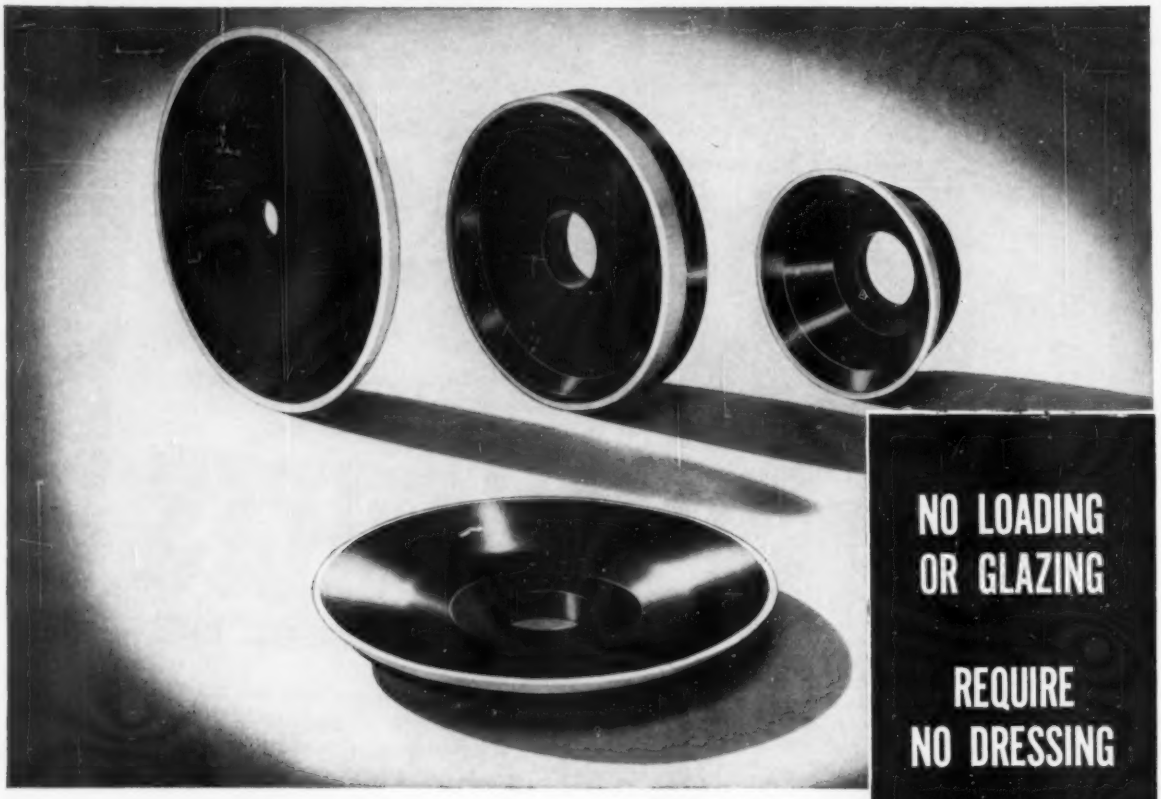
DANLY MACHINE SPECIALTIES, INC./2100 SOUTH LARAMIE AVE., CHICAGO 50, ILL.



NO LOADING
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BONDED
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GRINDING
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NATURAL
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DIAMONDS

# MANHATTAN DIAMOND WHEELS

## *CUT FASTER, COOLER . . . LONGER*

Every Manhattan Diamond Wheel is specially *bonded* to assure precision grinding at top speed without loading or glazing. Resinoid bonded for tungsten carbide grinding, they cut cool and free with lightest pressure . . . eliminate danger or damage to heat-sensitive carbide. Special metal bonds give you the finish you want for glass, quartz and ceramics. They require no dressing — for either wet or dry grinding.

Manhattan Diamond Wheels give you faster, cooler cutting action *plus* higher wheel efficiency and longer life on the toughest jobs. Specify from Manhattan's wide variety of surface-contact shapes . . . in the diamond concentration and grit size best suited for your surface, cylindrical, or internal grinding operations. You get "More Use per Dollar" with Manhattan Diamond Wheels.

RM 947

GRINDING WHEEL INSTITUTE

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**MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY**

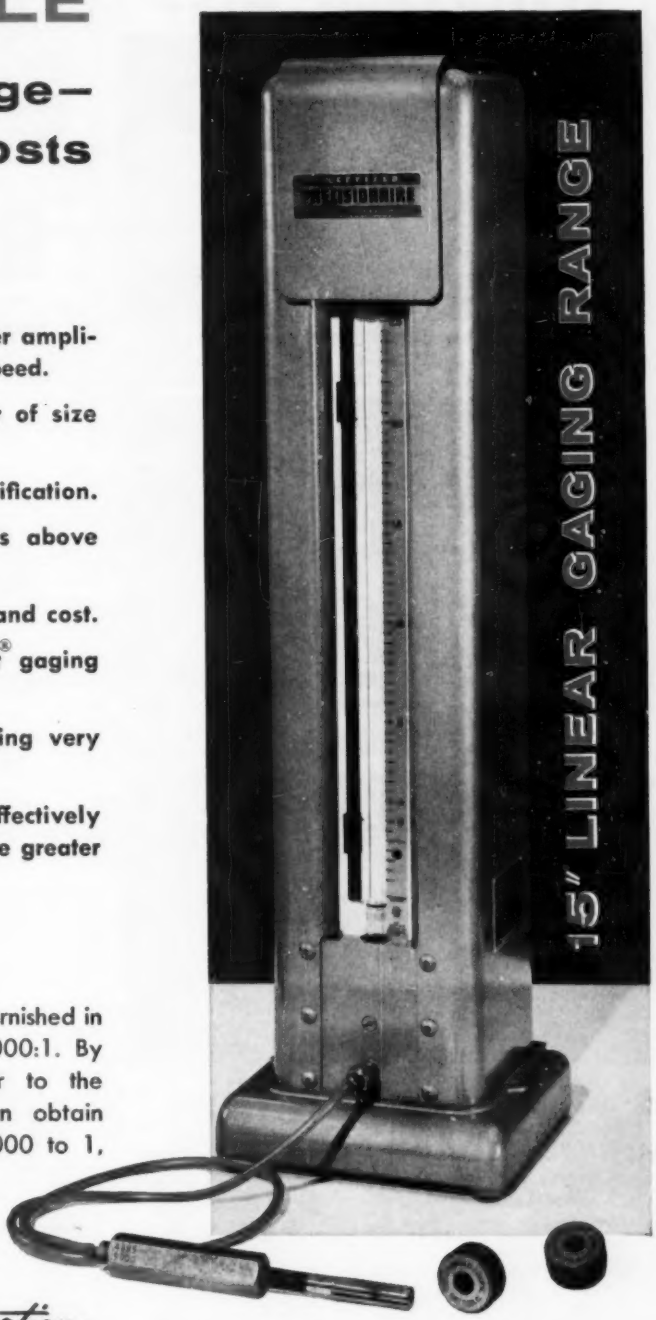
**RAYBESTOS-MANHATTAN, INC.**

Belts • Hose • Roll Covering • Tank Linings • Industrial Rubber Specialties • Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

# *New* LONG-RANGE PRECISIONAIRE®

## with 15" LINEAR SCALE

## Triples Gaging Range— Cuts Inspection Costs




### *Cost Saving Benefits*

**This new idea enables you to:**

- **Inspect wider part tolerances at higher amplifications with greater accuracy and speed.**
- **Classify parts into a greater number of size increments.**
- **Widen the scale spread for each classification.**
- **Accurately measure those deviations above and below tolerance limits.**
- **Reduce gaging equipment inventory and cost.**
- **Double the amplification of Plunjet® gaging cartridges.**
- **Obtain full amplification when gaging very small diameters.**
- **Watch machining operations more effectively with in-process gaging because of the greater come-up or approach interval.**

### *Broad Amplification Range*

The new Long-Range Precisionaire Gage is furnished in standard amplifications of 5,000:1 or 10,000:1. By adding the Sheffield Pneumatic Amplifier to the 10,000:1 Long-Range instrument, you can obtain 20,000, 40,000, 50,000, 80,000 or 100,000 to 1, amplification.

8362

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manufacture and measurement for mankind

**Call your local Sheffield representative for a demonstration or write to the Sheffield Corporation, Dayton 1, Ohio, U. S. A., Dept. 19.**

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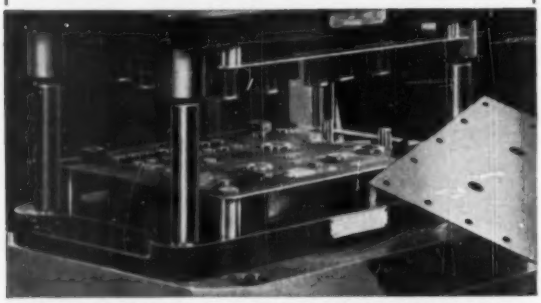
## are saving money with
# WHISTLER DIES



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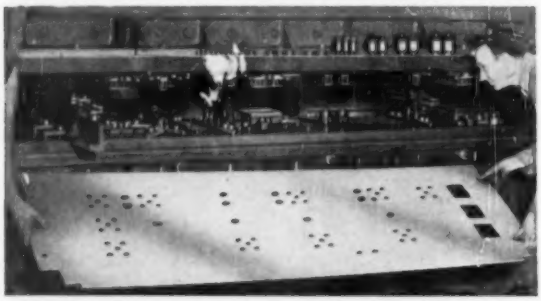
All parts reusable and interchangeable. Punches and dies stocked in .001" increments from .100" thru .500" dia. Larger sizes available.



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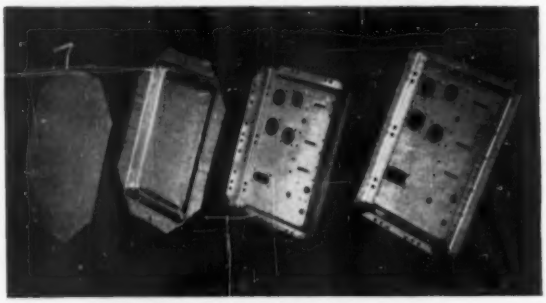

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Mail the following: ☐ Magna-Die Catalog ☐ Adjustable Die Catalog
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## CUTTING TOOLS AND HOLDERS...

***"finest ceramic tools made for heavy cuts"***

You can cut faster, finer, longer —and for less, with Ceroc cutting tools made from purest alumina. Outperform carbides from two to four times depending on material. For truly dramatic demonstration of superiority, contact—

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## BALANCING MACHINES

**UNMATCHED FOR**

- Speed
- Accuracy
- Ease of Setup
- Versatility
- LOW COST

It will pay you to get the facts about the complete line—for parts weighing from a few ounces to a ton or more.

*Write today for Bulletin 57.*

Trademark Reg. U.S. Pat. Off.

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# DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

*Write for sample on company letterhead*

THE DYKEM COMPANY
2303D North 11th St. • St. Louis 6, Mo.

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# WHATEVER YOU WANT A PRESS TO DO...

# THERE'S A BLISS PRESS TO DO THE JOB BETTER!

## Bliss makes more types and sizes of presses than any other builder

No matter how big or how complex that next metal stamping job may be, it makes sense to call on Bliss. Size never has presented any problem to us, and complexity is our specialty. And because Bliss makes more types and more sizes of presses than any other builder in the business, you're sure to get impartial counsel—sure that your trained Bliss representative will "grind no axe" for any one type of press. And remember this: he's backed by more than a century of experience in building presses of all types, all sizes, for all kinds of industry.

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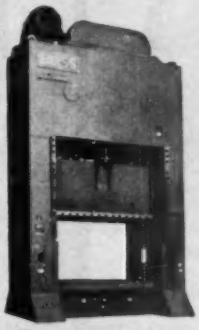
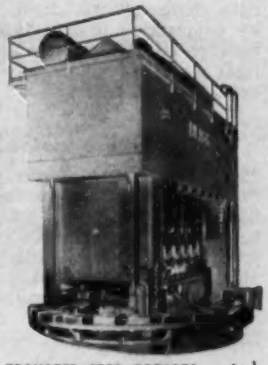
**INCLINABLE PRESSES** . . . in bench, single or double crank, modern enclosed design. With air friction or mechanical clutches, and whatever you need in cushions and feeds.

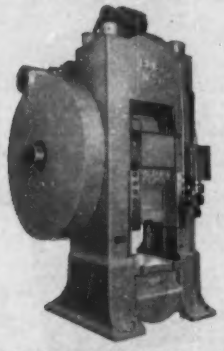


**STRAIGHT SIDE PRESSES** . . . eccentric and crankshaft models . . . any size . . . modern enclosed design, with whatever automatic features you want.

**HIGH PRODUCTION PRESSES** . . . specially designed for continuous high speed automatic operation. Up to 1000 spm. Available in a variety of sizes . . . and precision feeds.



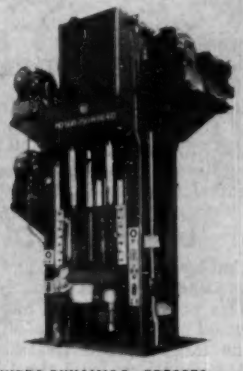
**TRANSFER FEED PRESSES** . . . for the ultimate in production. Bliss pioneered the development, now builds them for blank or coil stock work, with no limit on size.



**KNUCKLE JOINT PRESSES** . . . for slow, powerful application of pressure at near-bottom stroke. Bliss builds them from 75 to 10,000 tons capacity in 40 standard models for coining, embossing, extruding, sizing and swaging.

**FORGING PRESSES** . . . for production of turbine blades, crankshafts—hot forging, cold coining and other operations. Built in a number of sizes, from 300 to 4000 tons capacity, to standard and special design.

**TOGGLE PRESSES** . . . Double and triple action designs with quick advance and return speed features; modern electronic controls and automatic lubricating systems. From giant "automotive" sizes to compact units for small parts.



**HYDRO-DYNAMIC® PRESSES** . . . single action or double open rod construction or closed, 20 tons capacity to 35,000 or even more, standard design or special high speed models, electronic controls—Bliss has built them all.

Atrax

Precision Ground
SOLID CARBIDE
TOOLS AND BURS

# Job Applications

## NEW ATRAX DIA-MO CUT IMPROVES BUR PERFORMANCE ON STAINLESS AND HEAT TREATED ALLOYS

A new type of cut that produces a tooth form with three cutting edges on each tooth has many advantages over conventional Diamond Cut burs.

### EXCLUSIVE ATRAX DESIGN

By carefully controlling depth of flute, both left and right, and by engineering a definite ratio between the number of left and right flutes, a revolutionary bur cutting action results.

### 3 CUTTING EDGES

The chisel shaped tooth with three cutting edges produces a flake-like chip instead of the hard-to-control sliver-like chips produced by cuts ordinarily supplied on burs and the gritty, abrasive chips formed with the pyramidal type tooth on most Diamond Cut burs.

NOTE three cutting edges take shearing-type cuts producing smooth surface finish.

### SUPERIOR TO DIAMOND CUT

Instead of the wearing grinding action of Diamond Cut burs, the new Atrax Dia-Mo Cut actually cuts small chips similar to those produced by peripheral end milling.

### LONGER TOOL LIFE

Cutting action is faster and more positive and tool life is appreciably longer. This new type of cut has been shop tested and is recommended for cutting the toughest heat treated alloys and stainless steels. With the Dia-Mo Cut, "Bur-climb" is practically eliminated.

Fine Cut bur (left) produces long sliver-like chips. Diamond Cut bur (center) produces sharp, abrasive chips. Atrax Dia-Mo Cut (right) produces flake-like chips—gives faster, smoother cutting action.

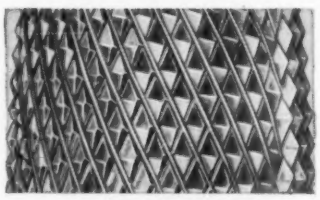
### FASTER PRODUCTION

In extensive shop tests, increased burring production is possible because of faster stock removal and reduced operator fatigue.

DIRECTION OF CUT

DIA-MO CUT

DIRECTION OF CUT



DIAMOND CUT

### IMPROVED SURFACE FINISH

Surface finish after burring with the new Atrax Dia-Mo Cut is superior to that produced by a Diamond Cut bur making subsequent finishing, grinding and polishing operations much easier.

It is recommended that the new Dia-Mo Cut be operated at 1/3 to 1/2 the speed of conventional burs for most efficient cutting action and uniform surfaces.

The new Atrax Dia-Mo Cut is available on request on 615 different bur sizes and types in standard, fine and coarse cuts.

We feel that this information can help you improve production, lower costs and discover the superiority of Atrax Solid Carbide Tools and Burs.

SEND FOR 148 PAGE "STANDARD REFERENCE" ON SOLID CARBIDE TOOLS . . .

**TO: THE ATRAX COMPANY**
**240 DAY STREET, NEWINGTON 11, CONNECTICUT**

# ANNOUNCING NEW HEAVY DUTY 6" AND 8" HICYCLE GRINDERS

Heavy Duty Hicycle Angle Grinder with rotating wheel guard.

Heavy Duty Hicycle Angle Sander with 9" pad.

Model CP-550-SG-4500 Heavy Duty Grinder maintains speed under load, lets the operator really lean into the work.

Here are two *all new* CP heavy duty Hicycle Grinders . . . brutes for power, demons for speed. Hicycle squirrel-cage induction motors running on 180 cycles, 220 volt, 3 phase current provide Built-in Overspeed Protection because maximum speed is always constant, always within safe wheel limits . . . speed sag under load is less than 15%.

New with these models is the CP *"Tri-Flo" Cooling* System that minimizes "hot spots". This highly efficient system cools motor windings, rotor shaft, main bearings, gear case and switch. Keeps the temperature rise at key points as much as 28° lower than with conventional type cooling.

**You get these 7 extra advantages with CP Hicycle Grinders**

1—*Hicycle Motor* of advanced squirrel-cage design means no brushes to replace, no armature to burn out. 2—*Power/Weight Ratio* is outstanding because high strength magnesium castings are used for motor, gear case and switch handle. 3—*Oil Sealed Ball Bearings* lubricated for life. 4—*Interchangeable* motors, motor housings, switch handles and switches on all straight and angle models. 5—*Heavy-duty switches* have dust tight seals and phenolic spacers for insulation from motor and to minimize vibration. 6—*Extra heavy micro-mesh gearing* heat-treated for long service. 7—*Guards* fully conforming to A. S. A. safety codes.

Write for complete information on these newest CP Hicycle Heavy Duty Grinders. Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.

**Chicago Pneumatic**

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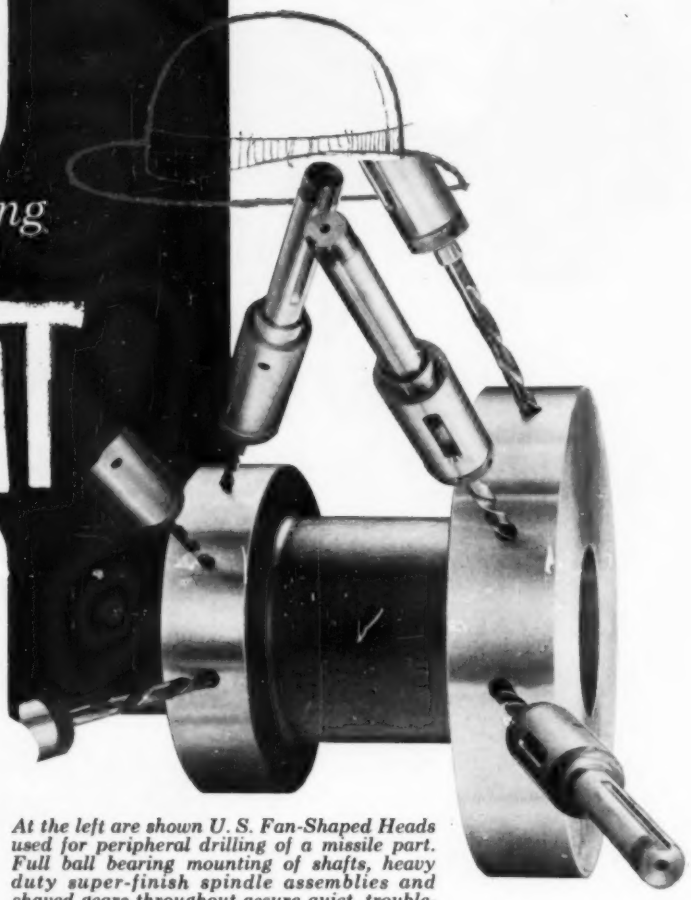
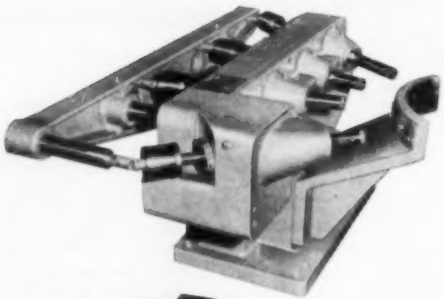
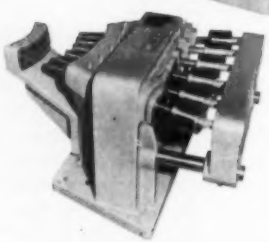
*Peripheral Drilling*
(even in missile parts)
*is*

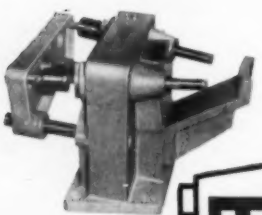
# OLD HAT

*to*
*U. S. Drill Head Engineers!*









*At the left are shown U. S. Fan-Shaped Heads used for peripheral drilling of a missile part. Full ball bearing mounting of shafts, heavy duty super-finish spindle assemblies and shaved gears throughout assure quiet, trouble-free performance . . . full torque and maintained drilling precision.*

Maybe your PERIPHERAL DRILLING jobs aren't *exactly* like this, but U. S. Drill Head engineers can show you the cost-reducing way to do them. They did it for a missile manufacturer on a part that involved the same problems . . . and the profit-making setup included the U. S. *Fan-Shaped* Heads shown here.

This is "old hat" for U. S. Heads in automotive parts, diesel engines and many other industries, too. And now, with the space age continually bringing new products — new manufacturing problems — it will pay you to take advantage of U. S. Drill Head Co.'s leadership in applying cost-reducing multiple drilling and tapping heads.

**Ask for recommendations on your particular drilling problems.**

US DRILL HEAD

Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

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## ASTE RESEARCH REPORT #19

**A reliable method for measuring the cooling characteristics of cutting fluids under actual cutting conditions. Do you know. . . .**

- *"Chip curl" influences cooling action of cutting fluids. . .*
- *A fluid can be* too good *a coolant. . .*
- *Fine-finish benefits of cutting fluid are controlled by tool temperature.*

**These and other previously unknown facts are discussed in detail in ASTE Research Report #19, "The Cooling Characteristics of Cutting Fluids," just published by the American Society of Tool Engineers' Research Fund. The Report is available to ASTE members at a cost of $.75 each and to non-members at $1.50. Orders should be addressed to ASTE Research Fund Director, 10700 Puritan Avenue, Detroit 38, Michigan.**

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## Top-Quality HOLDING TOOLS

● Better production machining methods at Seibert today make it possible to manufacture, in quantity, holding tools of improved quality without increased cost to you. The Seibert Shur-Lock adjustable adapter is one illustration. They are manufactured to precision tolerances from the highest quality hardened alloy steel, to give you the best in holding tools — certain to cut set-up time and give long service life. In addition, they are produced more efficiently than ever before which makes it possible to supply your needs promptly and at reasonable cost. Quality, Service and Price are the three reasons hundreds of users are today specifying Seibert tools. It will pay you to investigate the advantages of standardizing with Seibert.

Convenient starting ring for easy installation
Relieved key seat for easier setups—eliminates swell
Total concentricity held to .002" (total indicator reading) 6" from end of tool
Precision ground threads for accurate adjustment

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Drop us a line today and ask for Folio 2-50 and a Price List — or, ask to have a Seibert representative call at your plant soon to check over your tooling problems. There's no obligation.

Floating Holders

Drill and Tap Drivers

Magic Quick-Change Chucks

Spindle Extension Assemblies

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*Quality* MULTIPLE DRILL SPINDLES AND PRODUCTION TOOLS

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# Carr-Lane sends up a NEW STAR in the Tooling Sky it's the New SWIVEL SCREW CLAMP. . . better because

Threaded ball permits easy removal of swivel foot — for interchangeability — for assembly. SWIVEL ANGLE IS 40°, assures positive force with socket drive.

TWO FOOT STYLES • SOCKET HEAD or KNURLED HEAD SCREW • SIXTEEN SIZES FROM ¼-20 TO ⅜-11

VERSATILITY PLUS — Foot can be welded to fixture without danger to temper of ball!! HEAT TREATED AND RUST PROOFED

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LEPEL Electronic Tube GENERATORS—1 KW; 2½ KW, 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.

LEPEL Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

*WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.*

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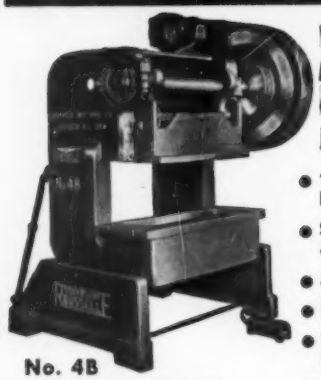
# New 40-TON DOUBLE CRANK O.B.I. ROUSSELLE



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*WITH NEW ELECTRICALLY CONTROLLED AIR CLUTCH*

- "Plug-in" foot and hand controls.
- Single stroke, continuous and jog selector.
- Low air consumption.
- Large die area.
- Roller bearing flywheel.
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CHOICE OF 30 SIZES AND TYPES IN 5 TO 40-TON PRESSES

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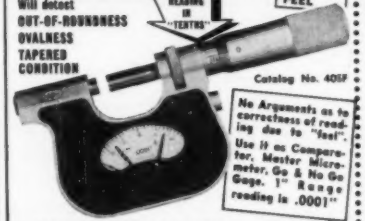
With the VISIBLE FEEL

Will detect OUT-OF-ROUNDNESS OVALNESS TAPERED CONDITION

READING IN "TENTHS"



Catalog No. 405F

No Arguments as to correctness of reading due to "feel". Use it as Comparator, Master Micrometer, Go & No Go Gage. 1" Range reading in .0001"

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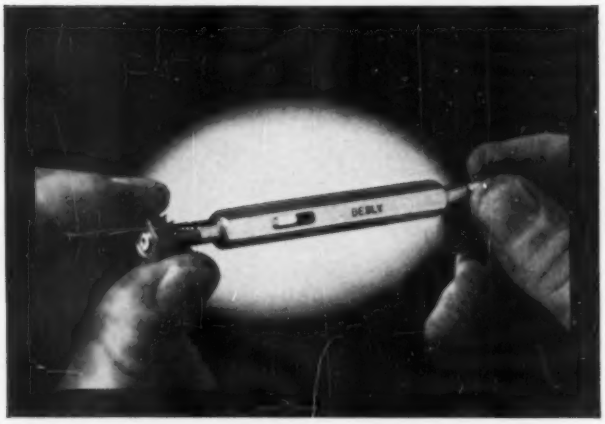
The flexibility in application of your Blanchard Surface Grinder enables you to attain peak production at lowest cost on hundreds of different grinding jobs. *But, it is very important that you use the right wheel for each job!*

Blanchard makes and stocks a great variety of silicate, resinoid and vitrified bonded wheels and segments. Ask your Blanchard representative to help you select the wheel — or wheels — best suited to your requirements. Call or write him today. And may we send you a copy of "The Art of Blanchard Surface Grinding" (4th Edition)?

THE BLANCHARD MACHINE COMPANY
64 State Street,
Cambridge 39, Mass., U. S. A.

# New Besly CP-75 precision gages last 3-5 times longer




Now you can have Besly Precision Gages in *extra hard* chrome plate. Made to tolerances according to U. S. Bureau of Standards specifications, Besly CP-75 precision gages last from three to five times longer than ordinary steel gages. They give you more piece parts per gage, less downtime for gage inspections, lower gage inventory, and will not chip or peel. See your distributor, or *write us today for catalog giving complete information on our full line and prompt service.*

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**BESLY-WELLES CORPORATION**

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Gages • Carbide Tipped Tools, Blanks, Lapped Toss-away Inserts and Holders



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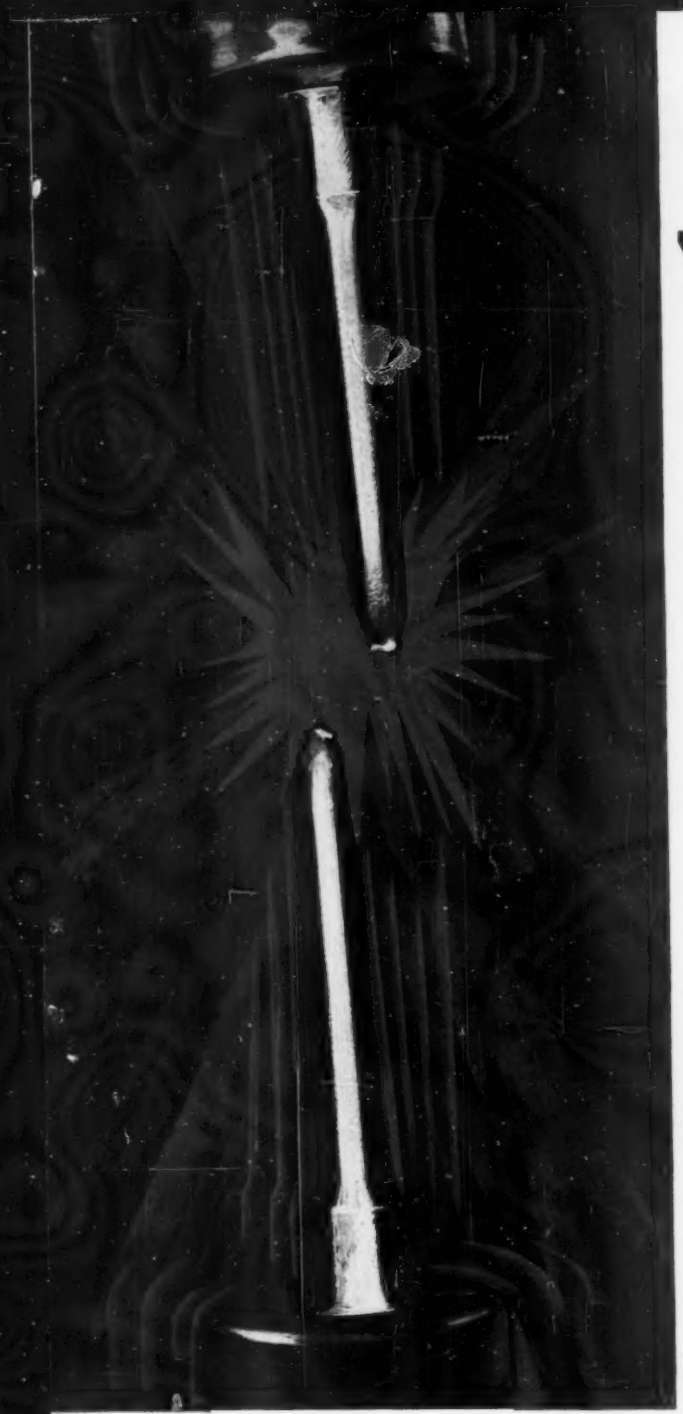


# "How Jessop Stretches Specialty Steels"

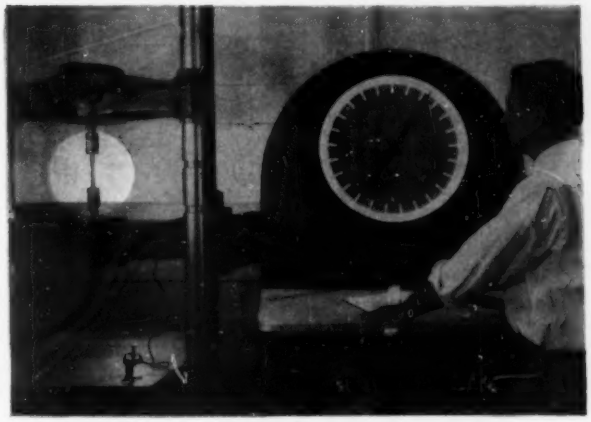
Robert Timko, Metallurgist

**"At Jessop,** tensile testing of specialty steels is carried out with far more than ordinary precision. It pays. It's one of the reasons our repeat business is so high.

"Based on a series of photographs, this drawing shows a specimen of type 304 annealed stainless steel bar at the climax of a tensile strength test. Moving apart, the heads of the tensile testing machine stretched the bar until it finally ruptured at 5500 psi above the spec."

In this Jessop metallurgical laboratory, top metallurgists using all types of modern testing equipment help us make certain you get *consistent* high quality in specialty steels. *Specify Jessop . . . and then relax.*

VMA 6788



Tensile testing machine in the Jessop metallurgical lab. Stretch, strain and then bang! The specimen of type 304 annealed stainless bar ruptured at 5500 psi above the spec. Tensile strength okay!

In the Jessop metallurgical lab, this tensile testing machine is one of many types of tools used to make certain you get *exactly* what you want in specialty steels.

Jessop Steel International Corporation
Steel Warehousing Corporation, Chicago
Green River Steel Corporation
Jessop Steel of Canada, Ltd.

JESSOP
STEEL COMPANY
Washington, Pennsylvania

Stainless, alloy, cast-to-shape, clad and forging steels, ground flat stock and other specialty steels

# General Electric announces the new Adjust-O-Breaker toolholder!

**Carboloy® toolholder with adjustable chipbreaker lets you adjust from any angle . . . offers any desired adjustment within its range* . . . features "floating" indexable chipbreaker with absolute repeatability.**

*MORE* jobs with *LESS* tooling—that's what you get with this new Carboloy® Adjust-O-Breaker toolholder! No need to have a separate chipbreaker for every cutting job. No need to restrict yourself to toolholders with only two or three chipbreaker settings. Now you can have this versatile new Carboloy toolholder . . . and *adjust it for any chipbreaker setting within its range.**

Available right now from stock in 5 styles, negative rake, for left- and right-hand machining, the Adjust-O-Breaker truly brings new meaning to disposable tooling.

So, to get cutting tool versatility that lets you handle *more* jobs with *less* tooling, check into the complete Carboloy line—Lift-O-Matic (positive rake, negative rake, and tracer), heavy-duty, and the new Adjust-O-Breaker toolholder. The complete line of Carboloy inserts, insert seats, convertible seats, and brazed tooling is the *broadest* in the industry . . . designed to meet *every* tooling need to give you BETTER PROFITS THROUGH BETTER TOOLING.

See your Authorized Carboloy Distributor now. He's listed in the Yellow Pages. *Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Street, Detroit 32, Michigan.*

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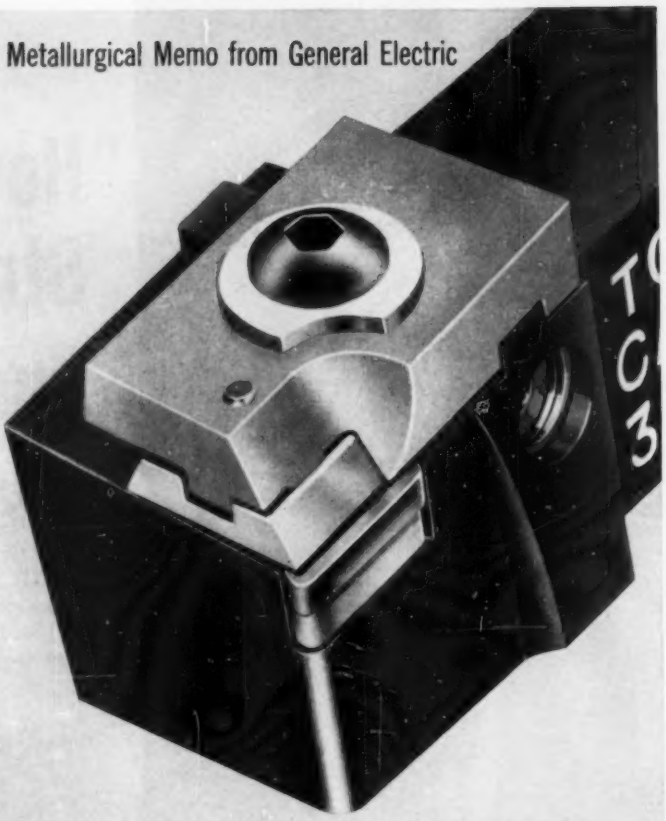
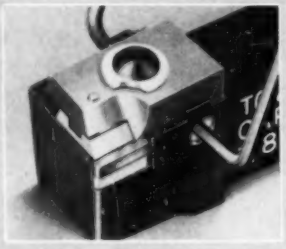
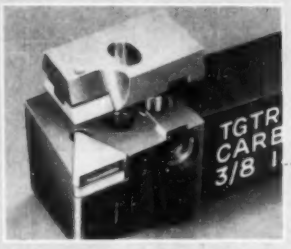
Metallurgical Memo from General Electric



*Sizes 16V and 85V: adjustable range 1/16" to 7/32"
Size 20V: adjustable range 1/16" to 11/32"

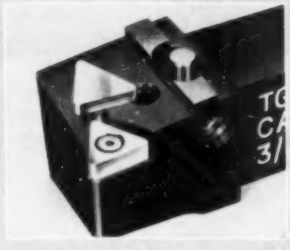


**1. Chipbreaker setting** adjusts to any width within range.* Set screw with two open ends provides access from either side. No springs to adjust.

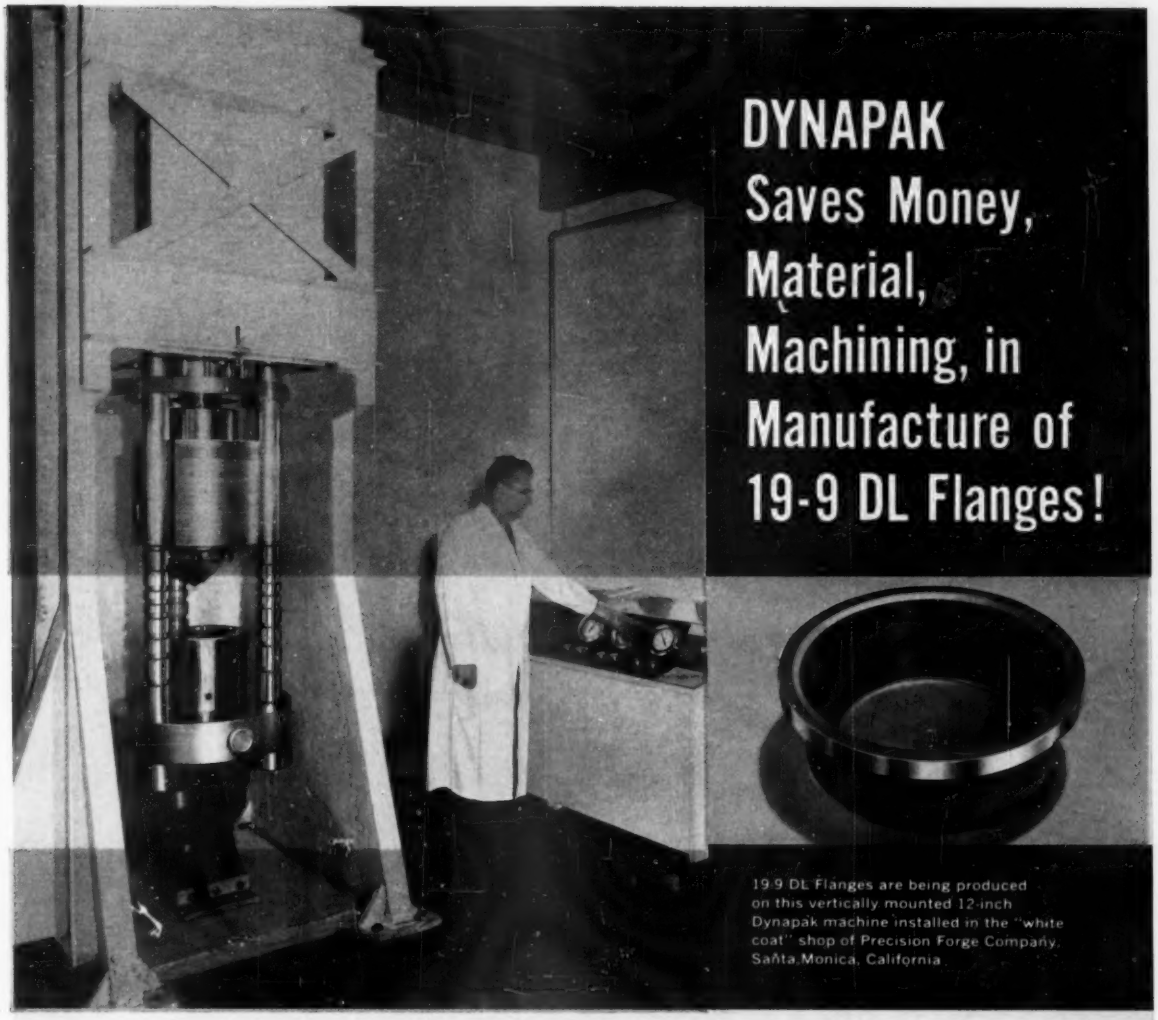


**2. Design permits** absolute repeatability of settings. Floating chipbreaker is indexable. Can't drop out when clamp is loosened.

**3. Clamp screw** is accessible from top or bottom; allows easy indexing or replacement even when toolholder is vertical or upside down.



**4. Standard disposable inserts,** Carboloy insert seats and convertible seat are used with toolholder. Insert seats are indexable and self-aligning.



# DYNAPAK Saves Money, Material, Machining, in Manufacture of 19-9 DL Flanges!

19-9 DL Flanges are being produced on this vertically mounted 12-inch Dynapak machine installed in the "white coat" shop of Precision Forge Company, Santa Monica, California.

## Here are the savings achieved in this Dynapak Application:

- MATERIAL: 60%
- TOOLING: 50% of the cost of conventional forging dies
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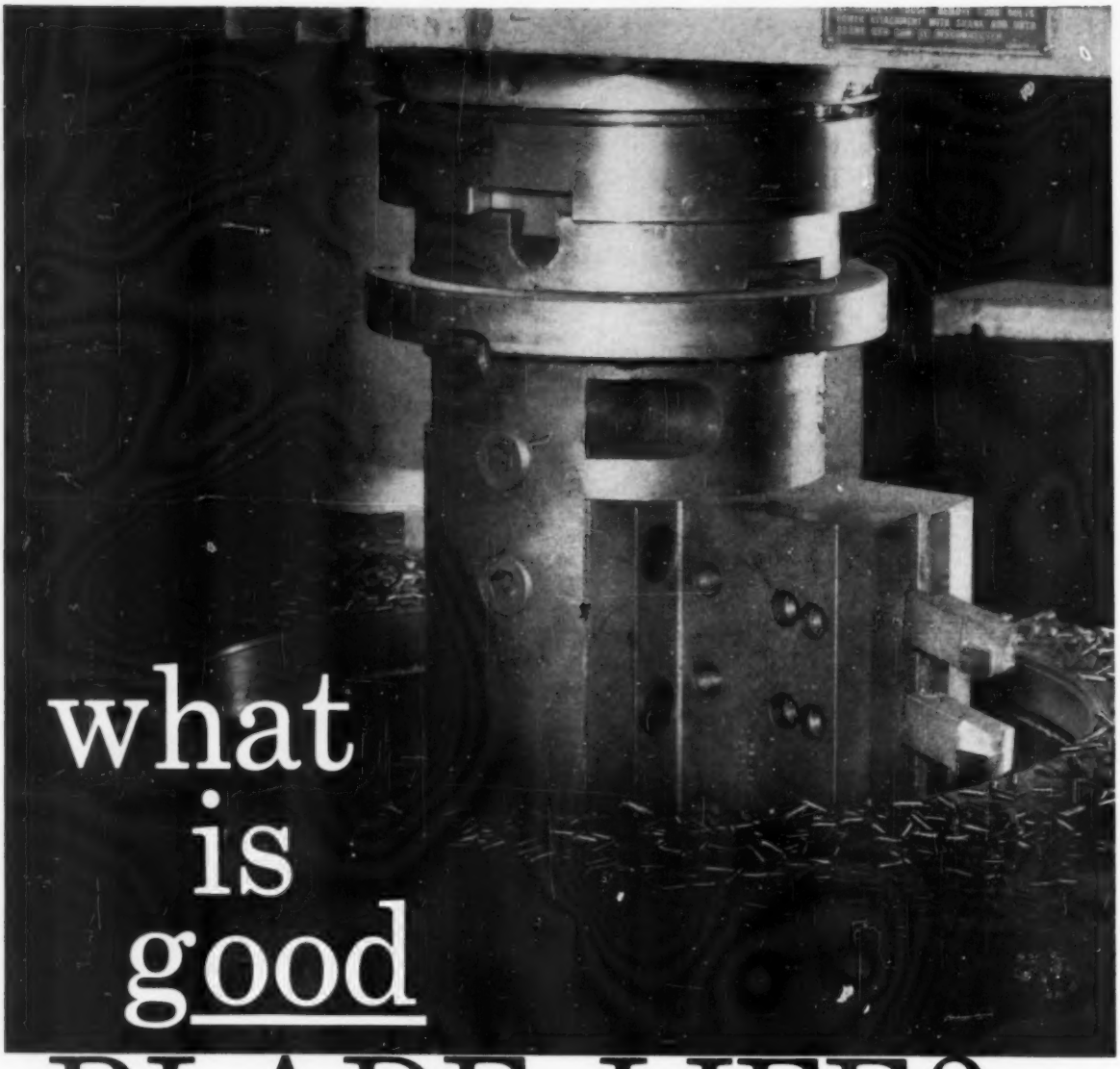

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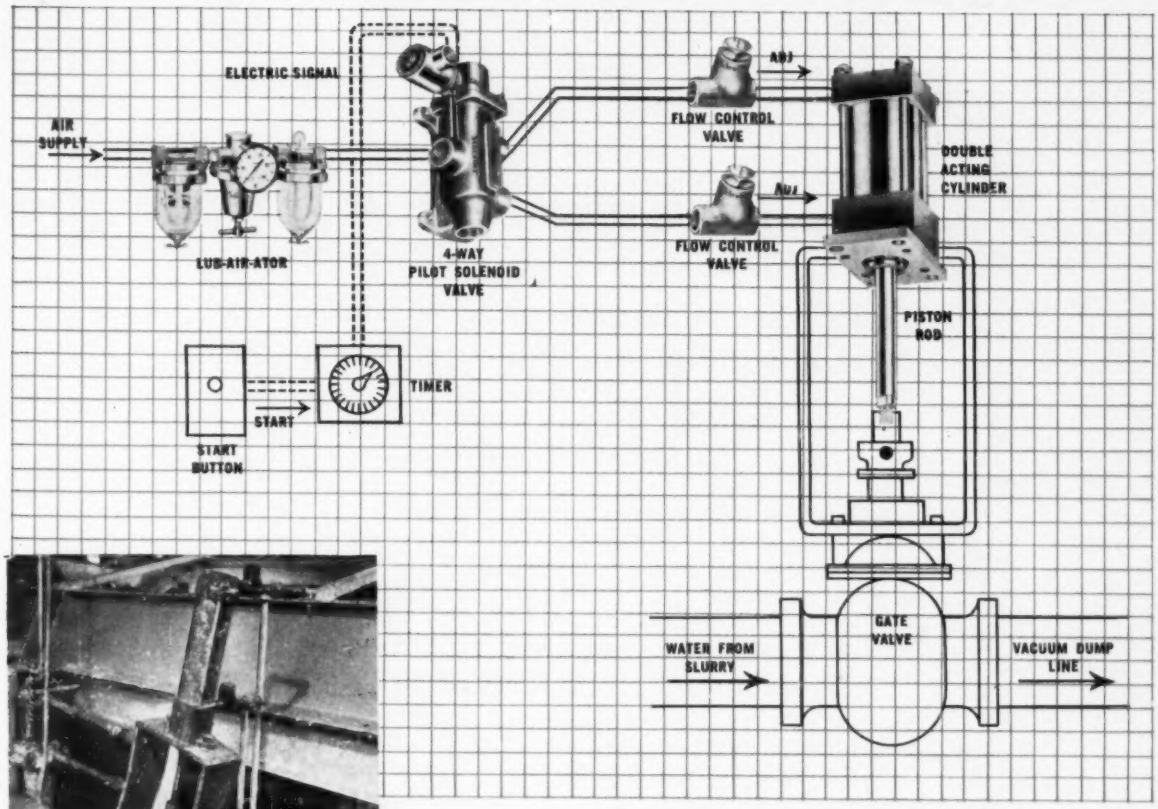
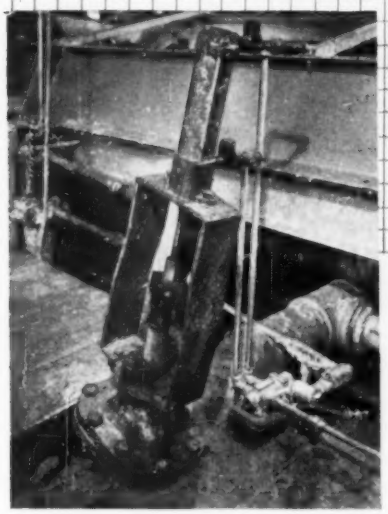
# PROCESSOR SPLITS PRODUCTION BOTTLENECK WIDE OPEN WITH HOOKUP OF STANDARD SCHRADER AIR PRODUCTS



Here's how one company automates with air. The hookup of Schrader Air Products in the large diagram actuates gate valves used in processing a slurry of raw asbestos fiber and cellulose at The Republic Seitz Filter Corporation, Newark, N. J. This used to be a slow, arduous manual job. Now air does it quickly, effortlessly, under "conditions particularly difficult for most kinds of automatic equipment . . . without a minute's downtime and without any maintenance whatever," says the company's Technical Director. Schrader-trained air specialists helped plan this practical set-up, as they have helped plan countless others.

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# Kingsbury machine cuts handling, makes big savings on Dexter locks

"Too much handling of lock parts causes nicking and burring. Then the assembled locks bind and we have to rework them," says Dexter Industries, Inc., of Grand Rapids, Michigan.

"Our new Kingsbury has cut our handling way down, eliminating nicks and increasing production by combining several operations in two chuckings of the work. We're delighted with it."

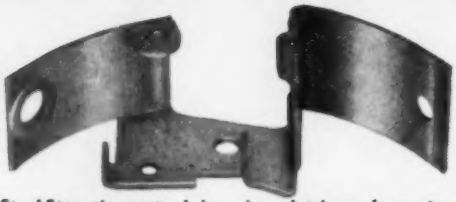
Each part passes twice around the machine. In the first chucking horizontal units at six stations drill the six pin holes, locating within .001. In the second chucking vertical units operate a broach and a combination tool. The last operation deburrs the pin holes; an air cylinder pushes removable pins on a block into the six pin holes.

*Typical of what we can do for you.* This setup resulted from the joint efforts of our sales engineers and representatives with Dexter's engineers and production men.

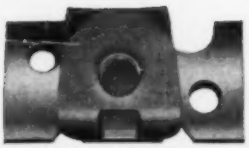
If you have drilling type operations in high production, may we make a proposal? Your Kingsbury will have good basic design and accurate rugged construction. It will be ready to produce when you receive it and will keep on producing. Kingsbury Machine Tool Corp., Keene, N. H.

KINGSBURY MULTI-UNIT AUTOMATICS

# *produce your* STAMPED COMPONENTS WITHOUT SECONDARY OPERATIONS

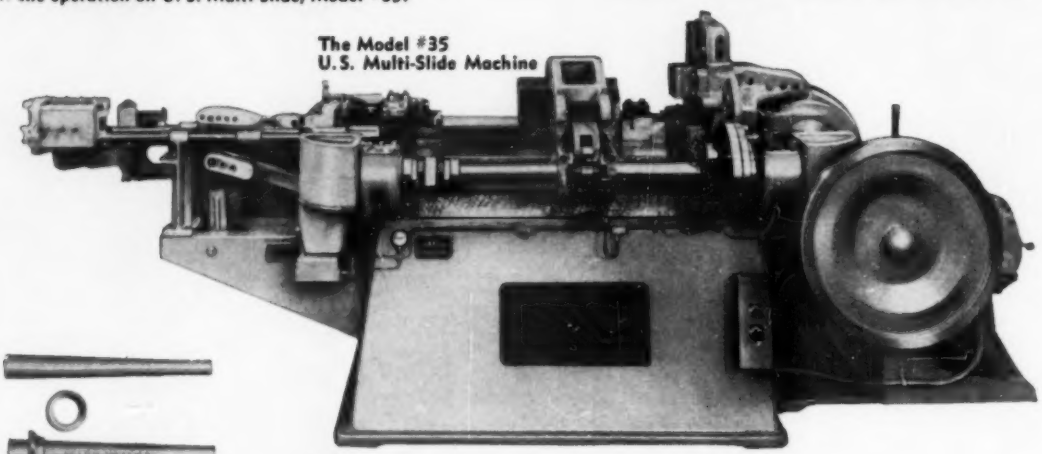


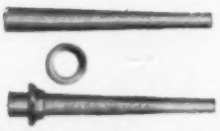
**Steel Stamping, actual size, pierced, trimmed, countersunk, beaded and formed on various planes. Produced in one operation on U. S. Multi-Slide, Model #35.**



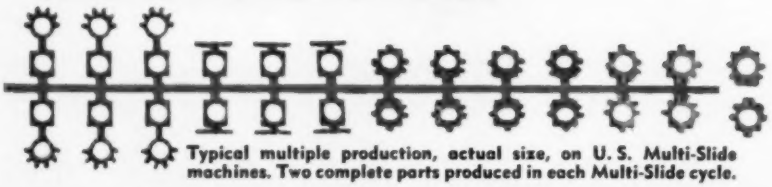
**Brass Stamping, twice actual size, pierced, trimmed, formed, counter-sunk and tapped in one operation on U. S. Multi-Slide, Model #33.**

**The Model #35 U. S. Multi-Slide Machine**





**Aluminum conical tube, actual size, and shaped collar assembly. Both pieces produced and assembled simultaneously in a single cycle of U. S. Multi-Slide, Model #28.**



**Typical multiple production, actual size, on U. S. Multi-Slide machines. Two complete parts produced in each Multi-Slide cycle.**

In a single U. S. Multi-Slide® cycle you can pierce — trim — countersink — bead — emboss — swage — tap — form — and assemble in almost any combination ● U. S. Multi-Slide "built-in motions" offer a practically unlimited variety of tooling possibilities. **In One Operation** you can produce components and assemblies that would ordinarily require multiple handling ● Stampings or assemblies produced on the U. S. Multi-Slide are consistently uniform and to required tolerances ● If you produce or purchase stamped components, investigate the cost saving potential of U. S. Multi-Slide machines. ● Ask for a copy of Bulletin 15-T or to compare manufacturing costs—send in samples or drawings of the part you want to produce.

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*Your Inquiries Invited.*

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"Monoball"®

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| | ANALYSIS | RECOMMENDED USE |
|---|---|---|
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| 2 | Chrome Alloy Steel Ball and Race | For types operating under high radial ultimate loads (3000-893,000 lbs.). |
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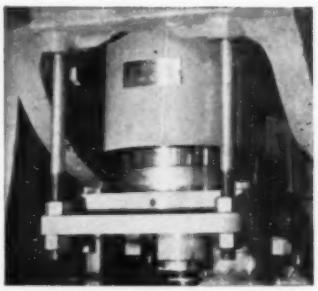

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Vol. 1 No. 11


## Subject: Facts About Thread Gages:

Plug and Ring Thread Gages are used to control the limits of the majority of threaded products manufactured. The economic value of this output alone suggests that users should demand the finest quality gages obtainable. Less than the best can result in passing parts that should be rejected and rejecting parts that should be passed.

There are ways for the user to determine if gages meet the highest standards of quality. They can be grouped into two categories as follows:

1. Inspect, check and test all gages within the capabilities of your own facility.
2. Insure quality beyond that revealed by your inspection and testing by knowing the integrity and proficiency of your gage suppliers.

## Normal Thread Elements:

Most users do not check thread elements beyond accepted commercial standards. One or more of the following elements are usually inspected: major diameter, pitch diameter, minor diameter, lead and thread half-angle.

Commercial and military specifications set definite allowable deviations for these elements but a quality gage has minimum variation assuring the user of the maximum product tolerance range.

## Hidden Thread Elements:

These elements have been understood and controlled for a relatively short time even by quality gage manufacturers. The problem is twofold, being one of detecting error through advanced measuring technics and eliminating error through refined manufacturing procedures.

1. **Helical deviation** (drunken helix)
   This is helix deviation from the true helical path. On a plug thread gage this means that the helix does not advance at a uniform rate. It is unlikely that this condition will be detected by conventional lead checking equipment. The result is an increase in the effective pitch diameter. A "Go" plug would then reject work which should pass and a "Not Go" plug pass work which should be rejected.
2. **Thick end thread**
   This term is applied to end threads if they have a thickness at the pitch diameter greater than one-half the pitch. A "ground only" or "stick lapped" gage is likely to have this error while a quality ground and "ring lapped" gage will not. Effective pitch diameter is again increased.
3. **Surface finish**
   The degree of surface finish on thread flanks has a definite bearing on wear life. Ordnance requirements specify a finish of 8 RMS maximum. This accuracy can only be achieved by "ring lapping" plugs and lapping rings with adjustable or progressive laps.
4. **Minor diameter eccentricity of thread ring gages**
   Quality gages have concentricity of pitch and minor diameters such that the calculated minimum effective minor diameter is not less than the basic minor diameter minus two times the sum of the gage makers tolerance for pitch and minor diameters. It is difficult to manufacture small sizes within these limits and the measuring problem is such that the user must rely in most cases on the reputation of the gage maker.

## Metallurgical Factors:

Close dimensional control of gages is put to practical use through wear life and stability. Quality gages are made of high speed steel or graphitic steel depending on size and style. Surface treatments and precision chrome plating are available for certain abrasive conditions. Hardness and toughness should be assured by the removal of amorphous skin.

## Summary:

What then are the ways for the user to evaluate the quality of gages and gage suppliers?

1. Become proficient in checking the normal thread elements and determining to what extent allowable deviations are used by the supplier.
2. Be aware of the "hidden" thread elements and inspect for as many as possible. Make certain that the supplier knows of these elements and considers them in the manufacturing process.
3. Be sure that the supplier has control in his own plant of the manufacturing process from raw stock to finished product. This should include metallurgical facilities and equipment for precision chrome plating.
4. Benefit from the experience of the supplier personnel. Do they serve on ASA and governmental gage committees? Are they the leaders or the followers?

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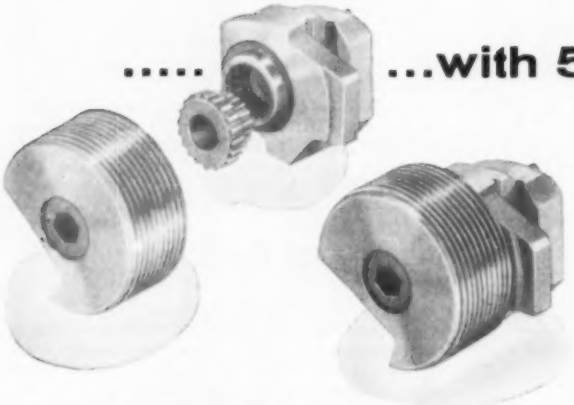

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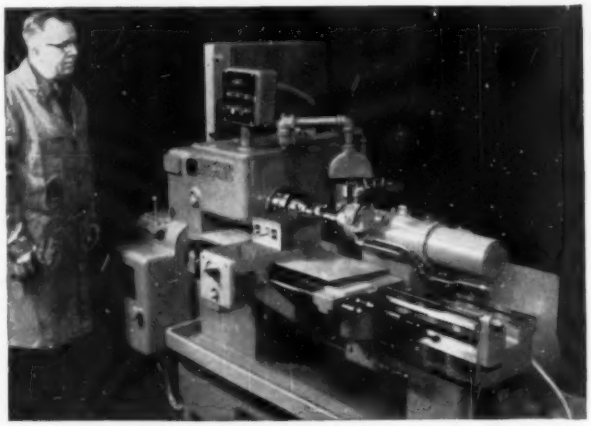

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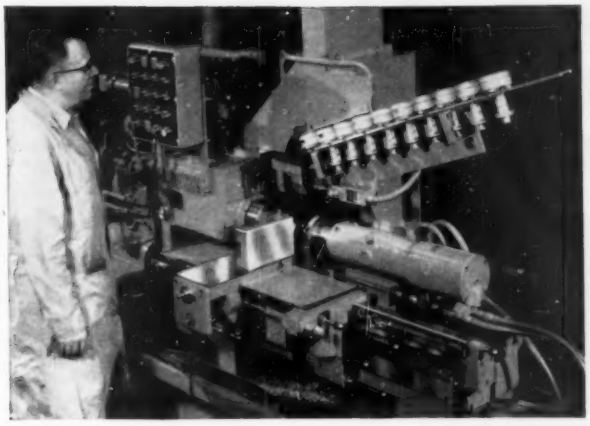
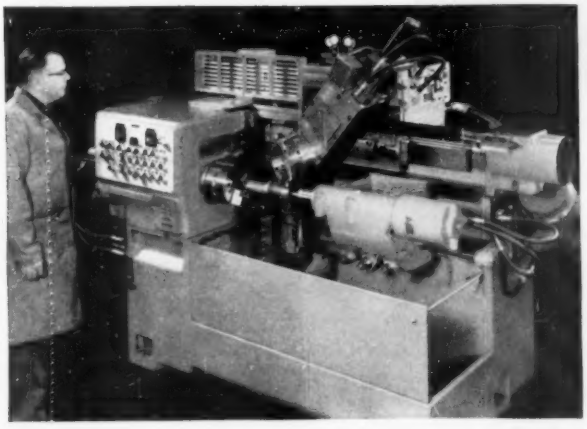
## Long Run Turning



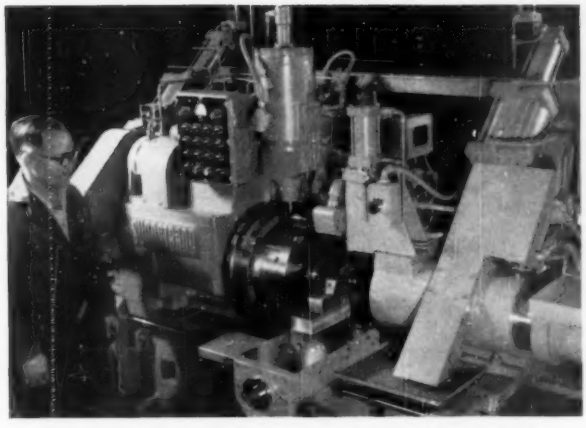
Automatic loading and ejection of work is provided on this Sundstrand automatic lathe. Production of die-cast aluminum housings is approximately 420 per hour with operations including turning the locating diameter and facing flange. This standard machine has a completely automatic cycle that includes part loading from hopper and ejection of finished workpiece.

## Tracer Turning



Up to three roughing cuts and a finishing cut are handled with a single template on the Sundstrand tracer lathe. The part shown is a shaft turned from a rough forging with two setups being required to finish both ends. Dial indicators on top of the tracing carriage permit roughing cuts to be set accurately. Finishing cut is .020 inch.

## Special Turning



This special lathe drills, bores, and chamfers differential carriers as well as turning each end, turning and chamfering pilot, and facing the flange on the large end. A total of 26 carbide tools are provided. Front and rear slides hold the turning tools with boring attachments through both the tailstock and spindle. Machine has automatic cycle except for manual loading and unloading of workpieces.

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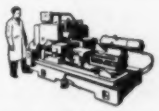
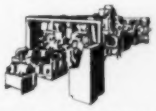
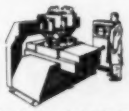


Automatic and Tracer Lathes
Bulletin A-110

Engineered Milling Production
Bulletin B-110



Examples of Transfer Machines—Bulletin C-110



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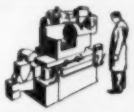

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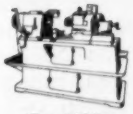

Thread Milling
Bulletin G-110



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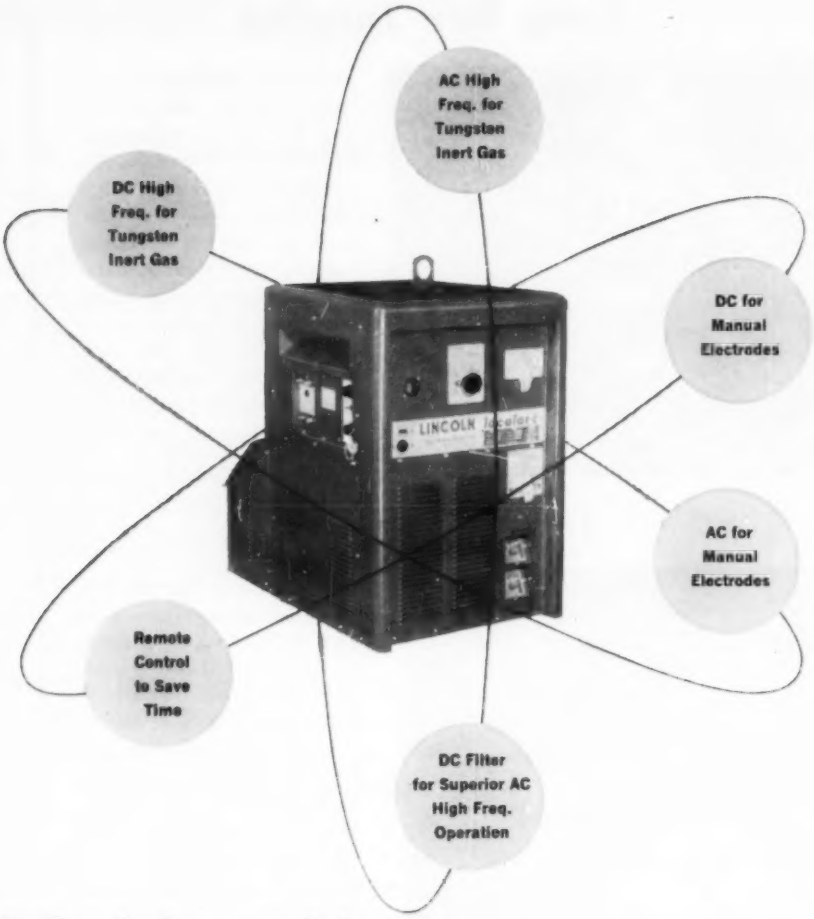
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# 1959

# the tool engineer

# Annual Index of Technical Articles

**Volumes 42 and 43**

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## HURRY! Enter the Gadgets Contest before December 31

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1. **ELIGIBILITY:** This contest is open to all members of the American Society of Tool Engineers.

2. **DEFINITION:** "Gadgets" are defined as tools or methods developed to solve specific production problems. They should contain a useful and practical idea or indicate an ingenious solution to a tool engineering problem.

3. **PRIZES:** One $100 first prize, two $50 second prizes, four $25 third prizes, and honorable mention awards which will be a choice of the Tool Engineers Handbook, 2nd Edition, or Die Design Handbook published by the American Society of Tool Engineers. Certificates will be awarded to all prize winners.

4. **PERIOD:** The contest will run from October 1 until December 31, 1959. All contributions to the Gadgets Department received from ASTE members during the period of the contest will be considered as entries.

5. **JUDGING:** Entries will be judged on the basis of originality and usefulness to other tool engineers. Also, clarity of illustrations, conciseness and completeness of presentation will be considered. Members of the ASTE National Editorial Committee will serve as judges. Winners will be notified by mail as soon as possible after completion of judging. A list of winners will be published in THE TOOL ENGINEER.

6. **ENTRIES:** The name and chapter affiliation of the author should be written on each page of the entry. No entries will be returned. Information which has been published previously in a periodical or national magazine is not eligible. All publication rights are assigned to THE TOOL ENGINEER. Authors of entries published in THE TOOL ENGINEER will receive honorariums.

7. **LENGTH:** Entries should be limited to 500 words or less. Sketches or photographs should be used to illustrate the methods or devices described in the text of the entry.

8. **MAIL ENTRIES TO:** Gadgets Contest Editor, THE TOOL ENGINEER, 10700 Puritan Ave., Detroit 38, Mich.

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*Dunham Tool Co.—June 15
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*Edgcomb Engineering & Engraving Co.—June 15, Nov.
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# LOOKING AHEAD

By T. W. Black
Senior Associate Editor

"Sputnik fever" caused the 11 percent fall-off in freshman engineering enrollments in the fall of 1958, according to Dean Dale R. Corson of Cornell. Many potential engineers have decided to study science, rather than engineering, because of the publicity that basic science has received as a result of satellite launchings and lunar probes.

The accelerating pace of technological developments presents a serious problem to engineering schools, Dean Corson points out. "We must train students today so that 10 years or five years or even one year from now they can work in fields that have not yet been invented."

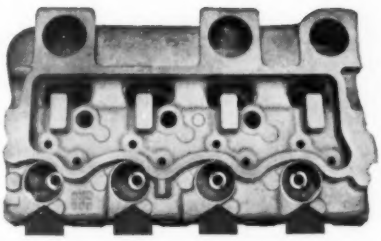
The need for new inventions is stressed by the National Inventors Council. The Council has published a list of 300 technical problems that must be solved. In the field of rocketry, for example, there is urgent need for a power source (other than nuclear) that will not require refueling on long-space flights. In the tool engineering field, a machine "which will make round, threaded metal parts out of square, round, or irregular pieces automatically, in about 15 minutes" is needed. A complete list of the 300 problems is available from NIC, U. S. Department of Commerce, Washington 25, D.C.

Solution to one technical problem—increased pig-iron output—has been announced by Koppers Co., Inc. A new ultrahigh-pressure blast furnace with a top pressure of nearly 40 psi, nearly four times higher than that in any existing American blast furnace, will produce double the output of a conventional furnace.

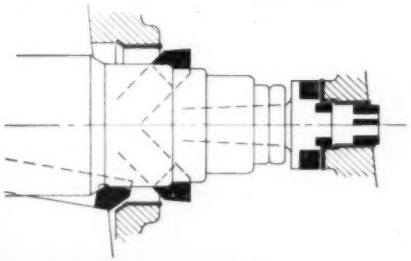
Another technical innovation—development of a coating that prevents formation of scale during heat-treatment—has been announced by North American Aviation, Inc. Applied by spraying or dipping, the new scale preventative adheres to the metal at furnace temperatures, forming an oxygen-tight seal. As the metal cools, the coating pops off by itself. Applications include stainless steel, nickel-chrome alloys, cobalt and copper alloys, and certain "exotic" metals.

High hourly wages paid to U.S. labor are not an excuse for inability to market overseas, says Bruce Payne, management consultant. Speaking at a Northwestern University Institute for Management meeting, Mr. Payne pointed out that American locomotives can be sold anywhere in the world at a profit, and that American coal is being sold abroad, despite the fact that American coal miners are the highest paid in the world.

Mr. Payne said: "It is impossible to gage labor costs in terms of wages paid. We must gage this cost in terms of cost of labor per unit produced. In many instances, because of our abilities to mass produce, we will find that labor cost per unit is competitive with that of an overseas company."



**MACHINES 21 CYLINDER HEAD SURFACES IN ONE PASS WITH DEPTH OF CUT BETWEEN 1/8" AND 3/16"**
Rough castings are bored, plunge-faced and chamfered at a rate of 18 parts per hour. Tooling is shown below.



# NEW!

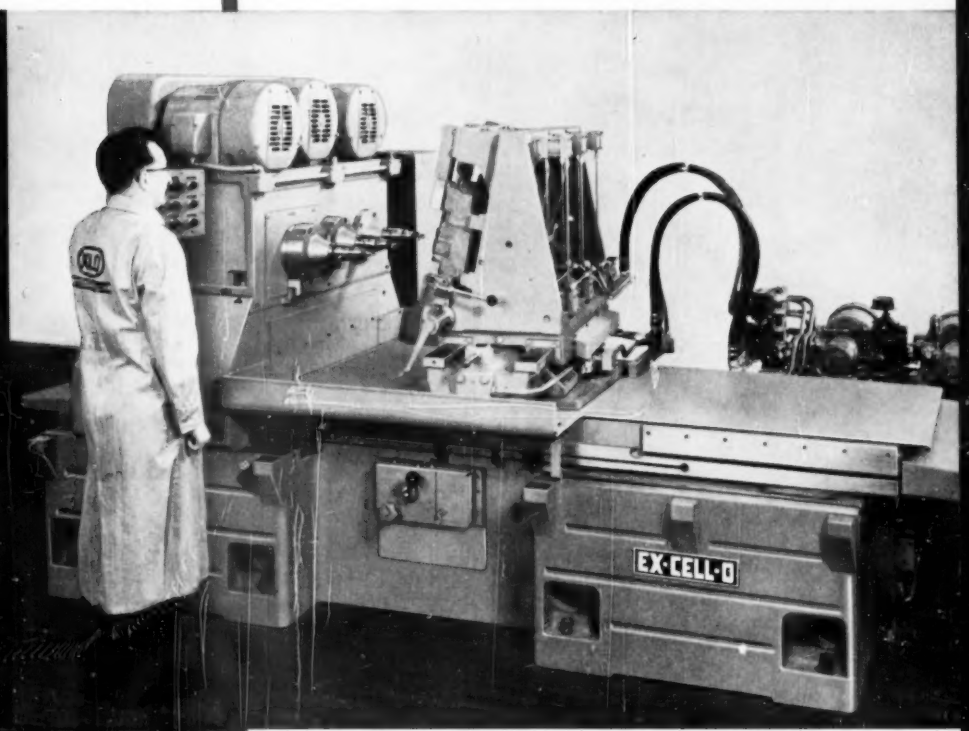
## Heavy-Duty Precision Boring Machine

From base to bridge-top, Ex-Cell-O's new Style 771 Precision Boring Machine is engineered to keep pace with changing production needs and built to give years of precise profitable performance.

A specialist in fast, heavy-duty work such as the multiple machining operations detailed at left, the Style 771 (and the companion double-end Style 772) provides ample work space for complex tooling setups and bulky fixtures.

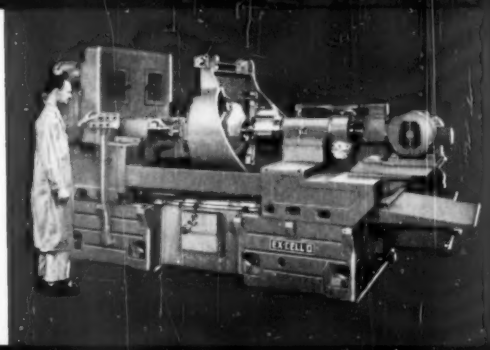
In-built versatility permits a broad range of rough, semi-finish and finish operations with automatic cycling. Rigid construction gives the "beef" needed for machining large, heavy parts, and supplies a wide margin of steadiness for high production of smaller precision parts.

Ex-Cell-O Precision Boring Machines can put greater precision into your products at lower per-unit cost. Get the full story from your local Representative, or write direct.




RIGHT: Style 771 machines both 4-and-6-cylinder tractor components. As cycle starts, table rapids to left, spindles rotate and feed traverse begins. At end of stroke, table rapids out to clear tooling; fixture indexes, cycle repeats for second set of holes.

BELOW: Double-end Style 772 performs multiple machining operations on tractor gear case cover.



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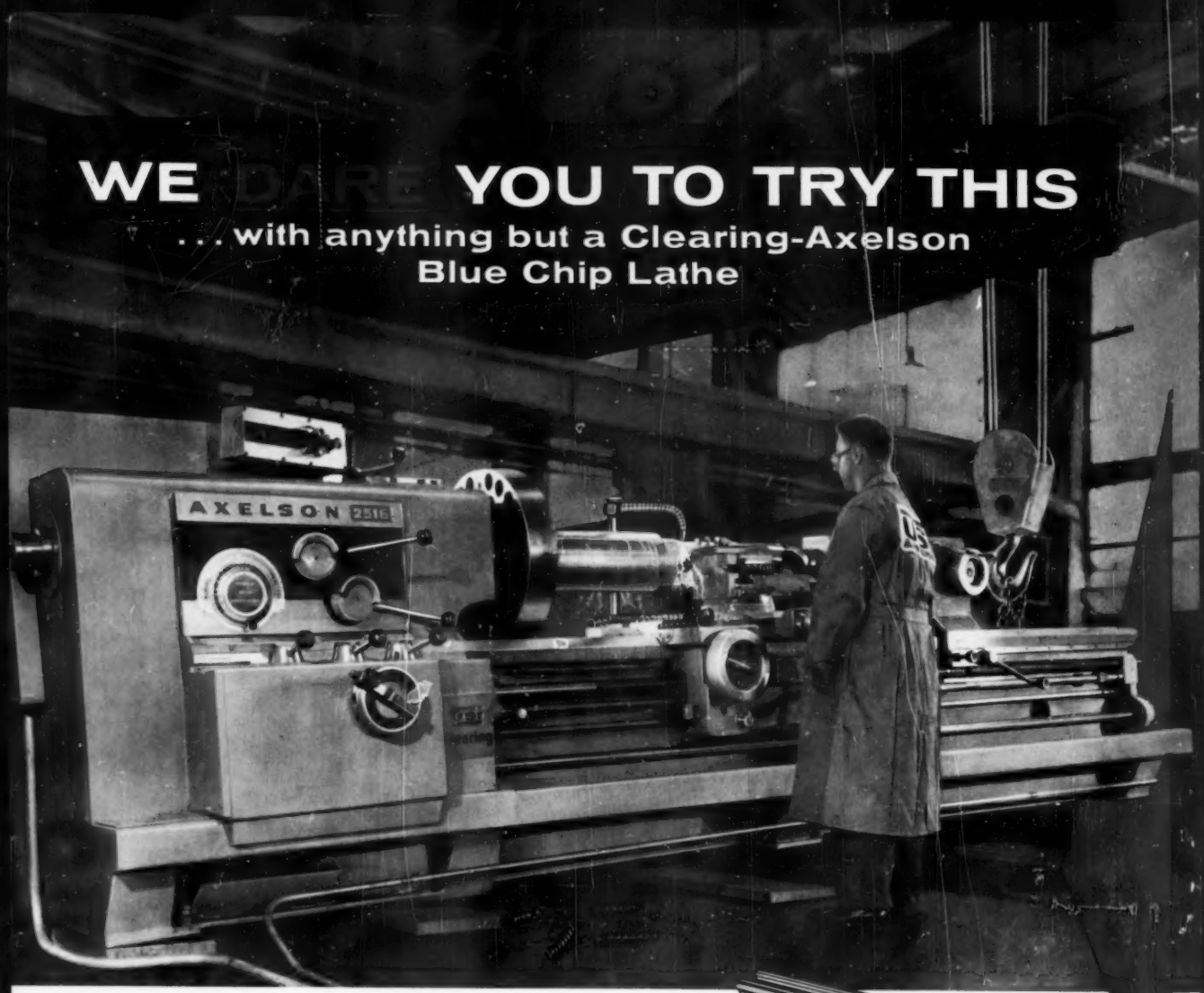
# WE DARE YOU TO TRY THIS

## . . . with anything but a Clearing-Axelson Blue Chip Lathe



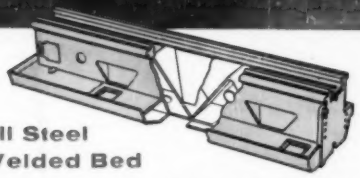

**A spine smashing test—Yet we got precision results on this ¾" cut under conditions that would make any other lathe sway-backed.**

Why bother to run a lathe suspended in air? Only to demonstrate the incomparable rigidity of the welded steel Clearing-Axelson Blue Chip lathe. This rigidity is absolutely permanent; it will maintain the precision of this machine through years of the most severe service.

And why, you may ask, is such enormous rigidity important?

Well, a lathe that can whistle its way through the toughest alloys yet provide vibration free operation has to be rugged. The Blue Chip lathe turns out more accurate work, faster—even when hogging off metal at a clip you would have thought impossible up to now. More horsepower permits use of latest tools—smooth, effortless operation saves you money on tooling.

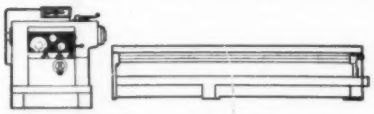
Clearing also manufactures the Clearing-Harrison lathe, presses of all types, dies and special tooling, and special equipment for the aircraft and missiles industry.



### All Steel Welded Bed

Stronger steel plate provides strength where it is needed. Pyramid shaped reinforcing ribs are used the entire length of the bed for high torsional rigidity.

### Modular Bed Construction



Headstock and bed on Blue Chip Lathes are built as separate units. Both are all steel weldments, fully stress relieved, and both are built-to-the-floor. That's how the Blue Chip lathe can laugh at obsolescence. Need a larger bed? Order a new bed but keep your existing headstock.

All the facts on the Blue Chip line of lathes are in this catalog. Write for your copy today.

USI Clearing

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